National Wood Products Extension Program

FY92 Annual Report (final)

F. Robert Mosdal, Program Leader
Dr. Theodore A. Peterson, Program Consultant

U.S. Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

Cooperative Extension System

Cooperative Extension Service
University of Wisconsin-Extension

USDA - Forest Service
Forest Products Laboratory


United States
Department of
Agriculture
National Agricultural Library

NWPEP

National Wood Products
Extension Program

FY92 Annual Report
(final)

Executive Summary

The National Wood Products Extension Program (NWPEP) has concluded the 3-year special project (89-EXCA-2-0677) funded by USDA-Extension Service and UW-Extension (Madison, WI), through a Cooperative Agreement, with major support from the USDA-Forest Service-Forest Products Laboratory (Madison, WI) where the project was officed.

NWPEP has demonstrated the value and potential of using the nationwide Cooperative Extension System (CES) network, in partnership with the Forest Service , for transferring forest products research information to information-providers, industry and the consumer. Continuation of the program with stable funding could build on the synergism of this unique, cost-effective forest products technology transfer partnership with ES-USDA, UW-Extension, and FS-USDA to effectively serve national needs.

<u>Situation</u>:

- ***declining national/state/local economies of urban and rural America***
- ***increased joblessness***
- ***declining industry competitiveness in domestic and global markets***
- ***mounting national debt and debt service costs***
- ***eroding national infrastructure***

Wood is a traditional and widely-used material, but technical knowledge about wood is not widespread. Only a few colleges and universities teach wood technology, and most engineers and architects do not know enough about wood as a material to properly use it. Builders use wood in traditional ways, and building codes are slow to include new design/construction methods and materials. Producers of wood products, wood product sellers, and woodusers would all benefit if they had more technical information about wood, wood products, and wood processing.

For over 80 years the USDA-FS-Forest Products Laboratory (FPL) has been a world leader in all aspects of fundamental wood products research. FPL, the single federal laboratory devoted solely to forest products research, has helped extend the world's supply of wood through more efficient raw material use, through increased product longevity, and through creative product development. Wood products research information from FPL and other agencies and universities is available, but underutilized, and is needed to help revitalize America.

Program Impact.:

• NWPEP provided a unique, cost-effective forest products technology transfer partnership between the national Cooperative Extension System (federal, state, county) and the U.S. Forest Service — Forest Products Laboratory (FPL). This mutual effort has leveraged the vital FPL national research investment being made.

• NWPEP promoted and accelerated the utilization of forest products research information for addressing pressing national needs, e.g., in rural development, industry competitiveness, forest products conservation, and recycling. This was done using traditional Extension methods, including the answering of over 2000 inquiries, a newsletter Extend (to a mailing list of 1036 information providers, including over 500 Extension professionals in forestry, forest products, housing, energy, ag engineering, community resource development, and rural development), and the development of audio-visual materials, as well as pioneering efforts using new electronic communications technologies for forest products information management and distribution.

• NWPEP provided a vital contact for CES professionals with the Forest Products Laboratory resources and a feedback mechanism to FPL researchers.

• NWPEP developed specific full-text databases for use on microcomputers (e.g., exterior wood finishing) for state/county CES professionals to enhance the timely retrieval and distribution of research-based information to meet local needs.

• NWPEP developed *in-house* a custom FPL CD-ROM disc to demonstrate the potential of this new electronic technology as a phenomenal storage and retrieval medium (full-text, graphics, and audio) and an emerging technology for forest products information management (information processing, accessing, and distribution).

• NWPEP initiated plans to develop a state-of-the-art Forest Products Research Information site at FPL for accessing and distributing information via the nationwide Internet electronic communications network. If completed, information-providers, including CES and agency staff, and industry users nationwide, would be able to quickly and efficiently access and retrieve relevant forms of information (e.g., documents, newsletters, databases, full-text information, and images) to meet their immediate needs.

Program Highlights:

- Full-text database development for microcomputers

Information professionals and users are challenged to search through thousands of new and old texts for data to keep updated and to provide information that clientele need and request.

Microcomputers can facilitate information management and access. NWPEP has prepared four comprehensive textbases on the subject of wood finishing. Recent major FPL research publications are the basis for each textbase: (*Finish*) Ag Handbook 647 "Finishing Wood Exteriors . . . ", (*Southern*) FPL-GTR-69 "Exterior Wood in the South . . . ", and (*Chronicl and Chronbib*) FPL-GTR-60 "Chronicle of 65 Years of Wood Finishing Research at FPL".

Users not only can search and view the textbase information on the computer screen, but selected text can be printed, exported to a file or word processor, or reorganized for other uses.

- CD-ROM disc development

NWPEP demonstrated the *in-house* development of a CD-ROM disc of FPL research-based wood information. CD-ROM technology offers the public an effective means for accessing wood research information. *Timely* access to current wood research information is fundamental to better timber resource use and to successful new product development amidst global competition.

CD-ROM disc players are available at reasonable cost for the large microcomputer user base. Each disc can store about 650 megabytes of information (text, graphics, and audio). On the FPL CD-ROM disc, for example, over 1300 pages of 12 major FPL wood-based research publications (full-text, graphics, tables, and photographs - including full-color) are linked to a powerful search/retrieval software program.

Large, comprehensive CD-ROM full-text databases can be searched at individual microcomputer workstations. Alternatively, a *library* of wood research information could be accessed via a CD-ROM disc network file server, such as the one envisioned at the FPL Forest Products Information site.

- **FPL Forest Products Information site**

Perhaps the most far-reaching and promising NWPEP activity involved the preliminary application of new electronic technologies dedicated to enhanced forest products research information management. Plans were initiated for the development and maintenance of an FPL Forest Products Information site, in cooperation with the UW-Extension WISPLAN computer staff, to serve as a fileserver on the nationwide/international electronic communications network (Internet). All state land-grant universities and the 1890 institutions are linked together by Internet. The U.S. Forest Service and other agencies can also access Internet.

Information-providers, including CES, agency staff, and industry users would be able to quickly and efficiently access and retrieve relevant forms of forest products information from the Forest Products Information file server to meet the immediate needs of their clientele. Information would also be available in electronic form ready for "publishing on demand". Cost-effective, timely distribution of fully-formatted documents and graphics would be possible from the FPL Information site via Internet.

NWPEP had proposed to develop and maintain the forest products databases for the FPL Forest Products Information site, utilizing various forms of electronic media for the system.

Source of 3-year Program Funding:

• ES-USDA —	$80,000 per year
• UW-Extension —	14,000 per year
• U.S. Forest Service-FPL —	20,000 per year

The National Wood Products Extension Program

• • • Opportunities for Technology Transfer

The importance of wood as a unique, renewable, energy-efficient raw material continues to increase in the U.S. and abroad. Serious lags in the adoption of new wood products information and technologies need not hinder the effective use of wood and the development of wood-based industries. Significant opportunities exist to improve the growing, harvesting and marketing of timber, the productivity and competitiveness of woodusing industries in rural America and the use of wood by consumers.

For over 80 years the U.S. Forest Products Laboratory(FPL) has been a world leader in all aspects of fundamental wood products research. FPL has helped extend the world's supply of wood through more efficient raw material use, through increased product longevity, and through creative product development. Wood products research information from FPL and other agencies and universities is available and needed to help revitalize America.

The National Wood Products Extension Program, located at the FPL, facilitated the transfer of wood products technology developed at the FPL and elsewhere, through the nationwide Cooperative Extension System. In this way, Extension was strongly linked with important national wood products technology transfer efforts of the Forest Service, other federal and state agencies, and industry.

The National Wood Products Extension Program published the *Extend* newsletter designed to inform Extension personnel about current wood products research information and educational materials. Other activities included the development of national communication networks for disseminating wood information and for targeting technology development and utilization (E-MAIL and computer bulletin boards), the development of educational packages and training materials (full-text databases and CD-ROM discs), and professional consultation on wood use.

The National Wood Products Extension Program was funded by ES-USDA through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with major support from the FS-USDA, Forest Products Laboratory at Madison.

Contact:

National Wood Products Extension Program

Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

F. Robert Mosdal, Program Leader
Dr. Theodore A. Peterson, Program Consultant

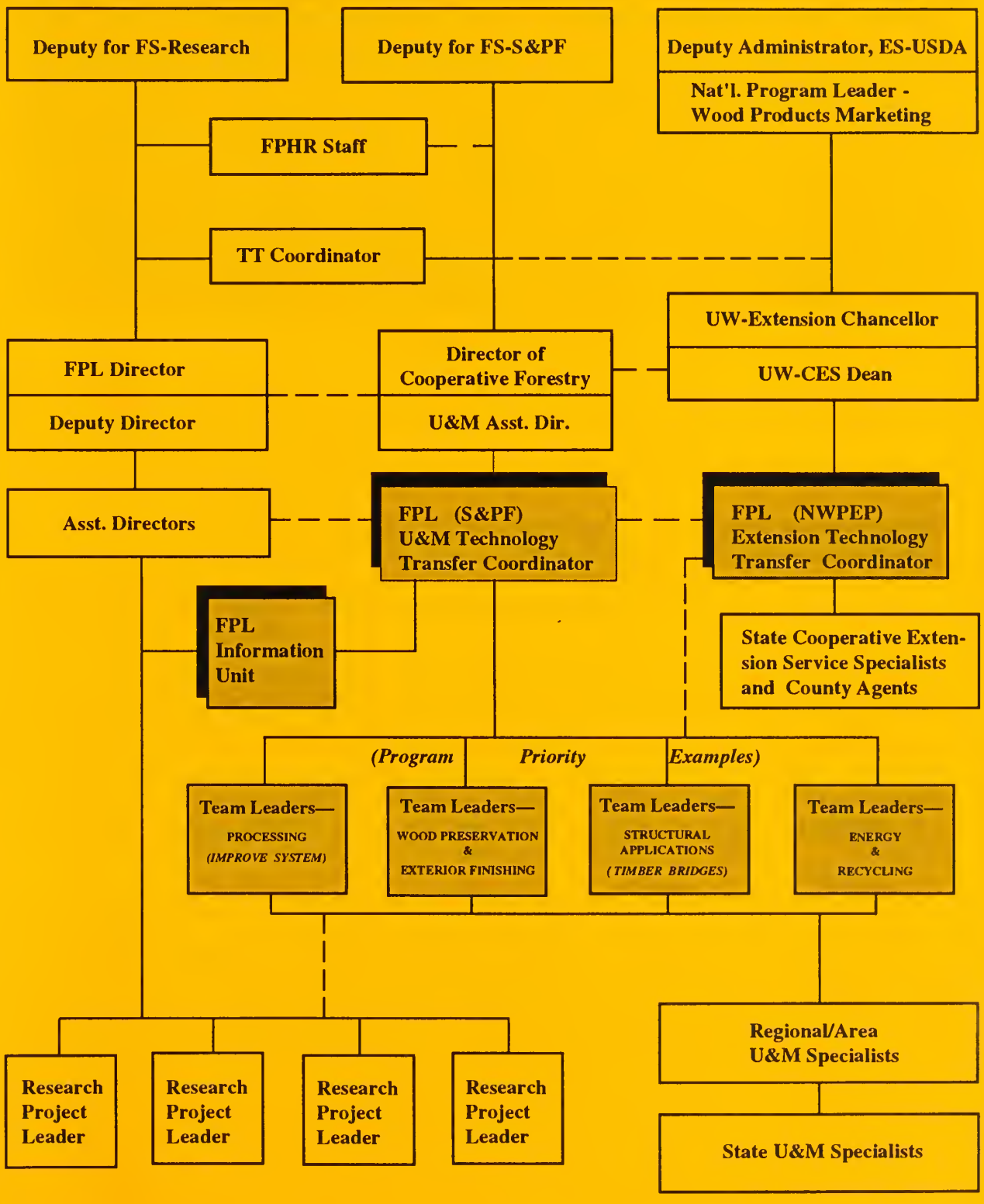
(608) 231-9330; FAX (608)231-9592; EMAIL Mosdal@WISPLAN.uwex.wisc.edu ; Peterson_T@WISPLAN.uwex.wisc.edu

UWEX COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

Technology Transfer Organization
USDA—FS—Forest Products Laboratory, Madison



National Wood Products Extension Program

– Mission Statement –

. . . to transfer to Extension professionals and clientele wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers, using the nationwide Cooperative Extension System (CES).

NWPEP Activities

1. Upgrading Program Capabilities

a. Microcomputer System

The limited UW-Forestry Department IBM-AT computer hardware/software equipment brought to the cooperative project in 1988 by Program Leader Peterson required upgrading to accomplish needed tasks. Enhanced computer memory and speed improved the output of the limited staff (1) and the ability of the system to more fully utilize graphics and page composition software.

The addition of a state-of-the-art scanning system during the second year provided an essential capability for accurately scanning and editing a wide range of printed text and graphics information. This equipment made possible better quality newsletters and brochures, the development of full-text retrieval software packages and the *in-house* development of a CD-ROM disc. An IBM-65-SX microcomputer system was later added as an independent workstation dedicated to textbase and CD-ROM development and electronic communications networking via Internet. The IBM-AT system was dedicated to the *Extend* newsletter preparation, to project administrative functions, and to electronic communications.

These equipment upgrades and purchases were made over an extended period of time because of severe budget constraints. Consequently, program development work could only proceed when appropriate equipment became available. In addition, this equipment was configured for use with University of Wisconsin facilities providing program support, rather than the Forest Service Data General computer system. The lack of system compatibility limited the FPL secretarial support which could be provided, however FPL microcomputer hardware/software capabilities have been recently expanded with NWPEP support.

b. Program Staffing

A major program strengthening occurred in March, 1990 with the hiring of F. Robert Mosdal as an Information Processing Consultant. Employed as a full-time academic staff member of the UW-College of Agriculture & Life Sciences (UW-CALS) School of Natural Resources, he was assigned to the National Wood Products Extension Program (NWPEP) at the Forest Products Laboratory (FPL). This personnel action effectively *doubled* the program staff to 2.

Bob provided effective leadership and support for several joint activities of NWPEP and FPL. The added staffing made possible the development of full-text databases and the custom wood-related FPL CD-ROM disc, and the initial development work for establishing a Forest Products Research Information node at FPL for Internet access.

This second-year personnel action and continuance was made possible within a very limited budget with first-year carry-over funds and planned budget constraints for subsequent years of the program.

c. Mailing Lists

Forest Service – FPL and S&PF secretarial staff provided program support in handling responses to inquiries and media requests. Newsletter and mass mailings were handled through UW-Extension.

A national mailing list of 1036 addresses was developed and maintained by modem from FPL by NWPEP staff on the UW-CALS computer system (WANG OFFICE). Prior to a mailing, an updated mailing list file was prepared by NWPEP and E-mailed to the UW-CALS Addressing Office for direct computer addressing of envelopes or self-mailer pieces (e.g., the *Extend* newsletter).

In the absence of Extension secretarial program support, this capability minimized the burden on NWPEP staff of maintaining and using the large, national mailing list (predominantly Extension professionals). (See Appendix , p. 16)

The mailing list has been utilized by FPL to reach Extension professionals on numerous occasions (e.g., publicizing Annual FPL Research Conferences). Hopefully some means for maintaining and updating the mailing list can be found, since access to such a list would be beneficial to both the FPL and the Cooperative Extension System (CES).

d. Establishing Computer Networks

A major emphasis of NWPEP was to promote applicable changes in CES information management (processing, accessing, and distribution of information), particularly in the forest products area, by adopting new communication technologies. Major collaborative efforts involved the completion of local connections between the NWPEP microcomputers and University of Wisconsin mainframe computers (UW-Extension WISPLAN and UW-Madison Academic Computer Center (MACC)).

These linkages make possible the timely, cost-effective distribution of information files to any CES professional (down to the county level) having an electronic mail address via Internet, the nationwide/international E-MAIL network. These accomplishments predated the completion of the national CES Communications System now under development.

E-MAIL provides the added capabiltiy of distributing fully-formatted information files (e.g., Postscript files) anywhere via Internet for "publishing-on-demand".

NWPEP staff acknowledge the excellent support and encouragement given to this effort by the staff of UW-Extension WISPLAN, UW-Administrative Data Processing, UW-MACC, UW-Extension Communications Development Center, UW-Extension Information Systems, and FPL.

2. *Forest Service Technology Transfer Collaboration*

a. Timber Bridges

Modern timber bridges are a viable alternative in rural America. Nearly one-half of the nation's bridges are considered deficient. 80% of the nation's bridges are in rural areas. NWPEP supported the national Timber Bridge Technology Transfer Plan (February 8, 1988) through media publicity and through *Extend* newsletter articles. The National Initiative is directed through the Timber Bridge Information Resource Center in Morgantown, WV.

The FPL is also involved in the National Timber Bridge Initiative. FPL, in conjunction with the National Forest System, has been active in timber bridge research and applications for over 20 years. Current research continues in the development and the testing of new bridge designs, such as the stressed-deck bridge. FPL scientists will monitor some of the demonstration bridges constructed under the National Initiative to determine their long-term performance.

There is need to be more proactive in promoting the use of wood in upgrading our national highway system, particularly in rural America. The Cooperative Extension System can play a major role in this collaborative effort if provided with access to relevant information. NWPEP has initiated preliminary plans for the in-house development of a Timber Bridge CD-ROM disc to meet this need. The disc would include the Timber Bridge Manual (Forest Service, EM 7700-8), research publications on design criteria, National Initiative demonstration bridge plans/bid information/costs, FPL monitoring reports on demonstration bridges, Department of Transportation regulations, and other relevant information. Such a CD-ROM disc would provide an important compendium of information for local decision-makers and for engineers who design bridges.

NWPEP has cooperated with FPL researchers (RWU–4716 Wood Products and Structures, and RWU–4515 Engineering Design Criteria) in arranging for industry site visits to view hardwood laminating practices. A focus of the National Timber Bridge Initiative is to utilize local hardwoods in the design and fabrication of bridges to utilize local timber resources and provide increased employment opportunities. There is a significant opportunity in some regions to facilitate the transfer of military-based production to peace-time production of products to rebuild our national highway system, particularly in rural America.

b. IMPROVE/INFORM

NWPEP, representing Extension, jointly implemented the national Integrated Mill Production and Recovery Options for Value and Efficiency (IMPROVE) system Technology Transfer Plan (February 10, 1988). Development of this FPL initiative was shared with the FPL Processing System Optimization research work unit (RWU–4719), FPL Information Services, and FS-State & Private Forestry(S&PF).

IMPROVE included eight major programs, each consisting of several computer routines that analyze aspects of a manufacturing process or lumber handling activity. The goal of IMPROVE was to help industry increase mill recovery and value potential by improving manufacturing efficiency. This would also improve the use of timber resources.

NWPEP collaborated with FPL researchers and S&PF staff in developing and testing several IMPROVE routines and User Guides. A major collaborative effort was given to the development and completion of the Lumber Product Size Analysis (LPSA) routine. (The same algorithms and formulas are also used in the Veneer Product Size Analysis (VPSA) routine.) Basic elements of the software program were translated from earlier joint Forest Service National Sawmill Improvement Program (SIP) and Extension Sawmill Improvement Special Project routines. LPSA assesses the performance of any log breakdown machine for dimension accuracy and is an effective tool for identifying causes of excessive lumber size variation. LPSA also provides the basis for a statistical quality control program for monitoring machine centers to establish and maintain acceptable levels of conversion efficiency.

More recently, the Forest Service IMPROVE program was changed to INFORM. Accompanying changes included the redrafting of the LPSA computer routine to a basic Statistical Process Control (SPC) routine, reflecting the need for industry to focus first on stabilizing a machine center process before trying to fix a faulty process. NWPEP collaborated in the development of the routine and supporting user materials and in marketing the national program to Cooperative Extension System professionals via the *Extend* newsletter and other contacts.

c. Northeastern States Technology Transfer Plan

NWPEP participated in an FPL conference (January, 1988) with FS-S&PF-Northeastern Area, state Utilization & Marketing specialists, and state Extension specialists. The purpose was to review on-going FPL research, to strengthen linkages between FPL researchers and Northeastern states specialists, to encourage user feedback on how well FPL research meets needs, and to identify potential technology transfer activities.

A summary meeting report was drafted in which seven technology transfer subjects were identified: Economic information, IMPROVE system, Saw alloys, Kiln drying, Moisture control in homes, Wood energy, Wood treating, and Public awareness.

Seven working groups developed technology transfer plans which were ultimately combined into the Twenty N.E. States Forest Products Utilization Technology Transfer Plan (June, 1988). NWPEP has collaborated with FPL researchers and S&PF staff at FPL in plan implementation.

d. Energy

The Mideast oil crisis underscored the growing importance of alternative energy sources. NWPEP has highlighted energy-related research information through the *Extend* newsletter.

The *Forest/Energy* newsletter of the Forest Service Energy Coordinator at FPL, distributed internally to Forest Service staff via the Data General(DG) computer network, was placed on the UW-Extension WISPLAN computer bulletin board for access and downloading by CES information-providers. This is an example of using available electronic communications networks for timely, cost-effective nationwide distribution of information to program partners.

e. Finishing Wood Exteriors in the South Technology Transfer Plan

NWPEP was an active participant in developing an action plan to revise USDA AH-647 "Exterior Wood Finishing . . ." to make the information more relevant to Southern conditions and to implement a multi-year technology transfer plan for disseminating the information.

A full-text retrieval database (Southern) was prepared, based on the new publication FPL-GTR-69 "Exterior Wood in the South . . ." and this entire document, including color illustrations, was included on the FPL CD-ROM disc developed by NWPEP. Both products were demonstrated at the "Finishing Southern Wood Exteriors Workshop" held in September, 1991 in Shreveport, LA. The full-text retrieval database has been widely distributed to information-providers, architects, and industry.

f. FS-S&PF Technology Transfer at FPL

Opportunities to collaborate in forest products technology transfer activities between the Forest Service and the Cooperative Extension System were enhanced by the creation of a full-time Forest Service – State & Private Forestry Technology Transfer Coordinator at FPL in 1988 (See Organization Chart, p. 7).

NWPEP worked jointly with the Coordinator in developing and distributing information packages. Following are two examples:

(1) Special Forest Products Task Force

NWPEP staff cooperated as a member of the task force in 1989 to develop a draft outline for the revision of USDA Ag Bull. No. 278 "*Rural Development Opportunities in Special Forest Products*". Subsequently in 1991, assistance was given in evaluating technical proposals of bidders to actually update the publication. NWPEP offered to prepare a full-text retrieval database of the final edited manuscript to supplement the hardcopy format for users.

(2) U & M Newsletter

The Coordinator prepared and distributed a monthly newsletter on the Forest Service Data General (DG) computer system. This newsletter was not a duplication of the NWPEP newsletter. To broaden its distribution to include Extension peers, the electronic file was slightly modified and transferred by modem to the UW-Extension WISPLAN computer bulletin board for access and downloading by nationwide Cooperative Extension System information-providers.

g. Other FPL Collaborative Activities

(1) Research Work Unit (RWU) Program Reviews and Assistance

NWPEP participated in the FPL supervisory reviews of RWU 4707 — *Wood Surface Chemistry and Protection* and RWU 4719 — *Processing System Optimization*. These research areas represented priority emphasis areas for technology transfer through NWPEP. The reviews provided a better understanding of the unit mission, the status of ongoing and projected research, and the opportunity to provide feedback to the research scientists. Physical on-site presence of the NWPEP staff at the Forest Products Laboratory increased the effectiveness of mutual technology transfer efforts.

NWPEP collaborated with a research scientist in RWU 4710 — *Fiber Processes and Products*, in a revision of an FPL paper on the Progress in Paper Recycling.

Program staff provided support for FPL research scientists in RWU 4515 — *Engineering Design Criteria* and RWU 4716 — *Wood Products and Structures* by arranging for industry site visits to view hardwood laminating practices. This was important to on-going timber bridge research and the focus of the National Timber Bridge Initiative to utilize local hardwoods in the design and fabrication of bridges.

These FPL / industry contacts have been highly useful to a private firm in planning for alternative domestic products after the completion of current Navy contracts.

(2) FPL Inquiries, Visitors, Conferences

NWPEP answered over 1000 public queries annually on forestry and forest products concerns. The Extension presence at FPL significantly reduced the disruptive impact on research staff productivity in handling routine inquiries.

NWPEP staff were involved in numerous visitor group (HOST) programs organized by the FPL Information staff. In addition, independent office conferences were held with Extension specialists, University research/teaching staff, and industry representatives from other states and countries.

NWPEP staff participated in annual FPL Research Conferences and meetings of FPL advisory groups, e.g. CORE.

3. *Model Program Developments*

The following activities demonstrate the forward-looking view taken by NWPEP to accomplish the technology transfer mission of the Cooperative Extension System — *"to integrate knowledge and technologies into user-oriented packages"* (Technology Transfer Subcommittee of Research & Education Committee, USDA – March 1989 report).

a. Full-text Computer Databases

Information providers and user-clientele are challenged to find and search through thousands of new and old texts, to keep updated and to provide needed information.

Four full-text databases were developed on the subject of Exterior Wood Finishing to provide a research-based package of information for information providers. Over 1200 inquiries per year are received by FPL alone on this subject, indicating the public need for credible information on exterior wood finishing.

The Finish databases include the full-text of three research-based publications: Ag Handbook 647 - *Finishing Wood Exteriors . . .*, FPL-GTR-60 — *Chronicle of 65 Years of Wood Finishing Research . . .*, and FPL-GTR-69 — *Exterior Wood in the South . . .* (see Appendix 2, Brochure).

These information packages were prepared to organize exterior wood finishing information, using unique commercial retrieval software, to help Extension specialists and County Extension Office staff and other information providers, answer public inquiries on the subject. Users can not only retrieve and view the textbase information on computer screen, but selected text can be printed, exported to a file or word processor, or reorganized for other uses.

Other subject matter packages were initiated, including a demonstration textbase (Colleen) on general wood-related references for use by FPL Information staff in answering inquiries.

b. *Extend* Newsletters

Information on current wood-based research programs was included in the newsletters (Appendix 4.) mailed to over 1000 information providers, enriching the national Forest Service and FPL-based technology transfer efforts. Aimed primarily at the Cooperative Extension System professionals nationwide, the Extend mailing list (Appendix 1.) included state Extension foresters, wood products specialists, ag engineers, housing and energy specialists, and other non-Extension information providers.

Newsletters were composed on microcomputers and camera-ready copy prepared for University of Wisconsin printers. A more timely, cost-effective distribution method was planned using the national Internet electronic communications network. Information providers would automatically receive electronic file editions as newsletter subscribers or be able to access downloadable files via E-Mail. The computer files would be either text-only or fully-formatted, graphics-rich files for Postscript laser printers.

c. FPL CD-ROM Disc

NWPEP staff demonstrated the feasibility and potential of *in-house* development of CD-ROM discs. CD-ROM technology provides an effective means for mass storage, access, and distribution of FPL wood research information. *Timely* access of current wood research information is fundamental to better timber resource use and to successful new product development amidst global competition.

CD-ROM disc players are available at reasonable cost for the large microcomputer user base. Each disc can store about 650 megabytes of information (text, graphics, and audio). The FPL CD-ROM disc produced contains over 1300 pages of text, graphics, tables, and photographs – including full-color– from 12 major FPL wood-based research publications, all linked to a powerful search/retrieval software program (Appendix 3. – Brochure).

Large, comprehensive CD-ROM databases can be searched at individual microcomputer workstations. Alternatively, a *library* of wood research information could be accessed via a CD-ROM disc network file server, such as the one envisioned at the FPL Forest Products Research Information site.

d. FPL Forest Products Research Information Node

Plans were initiated for the development and maintenance of an FPL Forest Products Information site in cooperation with the UW–Extension WISPLAN computer system. All state land-grant universities are linked together by a nationwide/international electronic communications network (Internet).

Information-providers, including Cooperative Extension System and other agency staff, and industry users would be able to quickly access and retrieve relevant forms of forest products information to meet their immediate needs. Information would also be available in electronic form ready for "publishing on demand". Cost-effective, timely distribution of fully-formatted documents and newsletters would be possible from the FPL Information node via Internet.

NWPEP proposed to develop and maintain the forest products databases for the Internet node, utilizing various forms of electronic media for the system. There is need to develop future information delivery systems which incorporate these networking capabilities. The Cooperative Extension System and the Forest Service have a significant opportunity now to develop and bridge their computer networks so as to enhance information management (information processing, accessing, and distribution).

Postscript

The National Wood Products Extension Program (NWPEP) has been funded as a special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the U.S. Forest Service, Forest Products Laboratory, Madison.

The major NWPEP program objective was to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System (CES). We have tried to assist our CES peers in various ways to accomplish this objective now and in the future.

NWPEP staff acknowledge with thanks the opportunity to pilot the special project for the past 4 years through the cooperative agreement with the Federal Extension Service and UW-Extension. We pay special tribute to the strong support of the Forest Service, Forest Products Laboratory, Madison, over the past 8 years, as this interagency program evolved. This unique partnership, indeed, is a prudent and cost-effective coalition to facilitate forest products technology transfer. We predict it will be reconstituted in the future by decision-makers who clearly understand the role such a partnership serves in addressing national needs.

The NWPEP staff (2) strongly advocated the use of emerging electronic communication technologies for and by Cooperative Extension Service professionals. In support of Extension information providers and their peers, we were early developers of full-text retrieval computer products, the *in-house* development of CD-ROM discs, and the initial proponent of a Forest Products Information node at FPL to be accessible on the nationwide Internet communication network. Unfortunately, the full implementation and support of these visionary activities will be delayed at best as NWPEP ends.

NWPEP, with a proud record of vision and accomplishment, can be viewed as an important chapter in the history of CES. More than a completed pilot program, however, NWPEP provides a significant example of warranted interagency partnerships that work and are needed to more fully meet the needs of our nation.

NWPEP

National Wood Products
Extension Program

Appendix 1.

Mailing List — for Extend newsletters, special mailings, and FPL announcements

NATIONAL WOOD PRODUCTS EXTENSION PROGRAM

MAILING LISTS (1992)

(Total Mailing - 1036)

Wisconsin

__ 1.1 Wisconsin Cooperative Extension Service (120)

U.S. Forest Products Laboratory

__ 2.1 Researchers & Administrators (150 -internal mailing)

Cooperative Extension Service

__ 3.1 ES-Administrative Council (11)

__ 3.2 Natural Resources & Rural Development Staff (15)

__ 3.3 CES Directors & 1890/Tuskegee Administrators (86)

__ 3.4 Extension Forest Products Specialists (67)

__ 3.5 Extension Housing & Energy Specialists (116)

__ 3.6 Extension Agricultural Engineers (132)

__ 3.7 CRD Specialists (76)

__ 3.8 Rural Development Centers (4)

__ 3.9 Other Extension Specialists & Agents (9)

Universities & Technical Schools

__ 4.1 Wood Products Researchers & Educators (31)

__ 4.2 NAPFSC Officers & Committees

__ 4.3 Vocational-Technical Schools

__ 4.4 Rural Technical Assistance (4)

Forest Products Utilization Specialists

__5.1 State/Regional/National FPU Specialists (136)

Forest Service (not FPL)

__6.1 Forest Products & Harvesting Researchers (7)

__6.2 RC & D (76)

__ 6.3 Expt. Stations & Station Libraries (20)

__ 6.4 Washington Offices and Field Offices (13)

State

__7.1 State Foresters (50)

__ 7.2 District Foresters & Specialists

__ 7.3 Nat'l. Assoc. of State Foresters

Legislators

__8.1 Legislators/Aides (1)

__8.2 Legislative Committees

Associations, National and Regional

__9.1 NFPA (1)

__9.2 Others (28)

NWPEP

__10.1 Advisory Committee

Media

__11.1 Specialized Magazines

__11.2 Professional Journals

__11.3 Newspapers

__11.4 Radio & Television

Federal

__ 13.1 Bureau of Indian Affairs (BIA) (5)

__ 13.2 CSRS

__ 13.3 USDA

Others

__12.1 Foreign (1)

__12.2 TVA and Other Professional (14)

NWPEP

National Wood Products
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Appendix 2.

Brochure — **Exterior Wood Finishing**
Full-text Databases

NWPEP

National Wood Products
Extension Program

Exterior Wood Finishing

Wood Products Information Management

WOOD PRODUCTS INFORMATION:

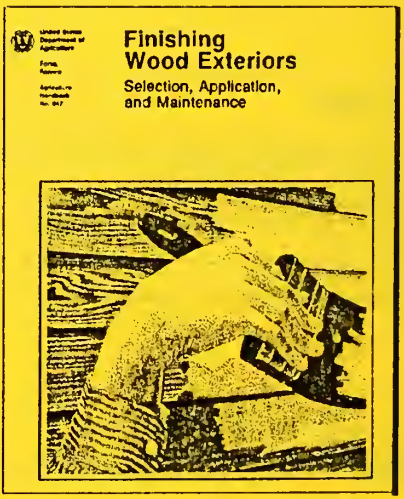
EXTERIOR WOOD FINISHING

Information professionals and users are challenged to search through thousands of new and old texts for data to keep updated and to provide information that people need and request.

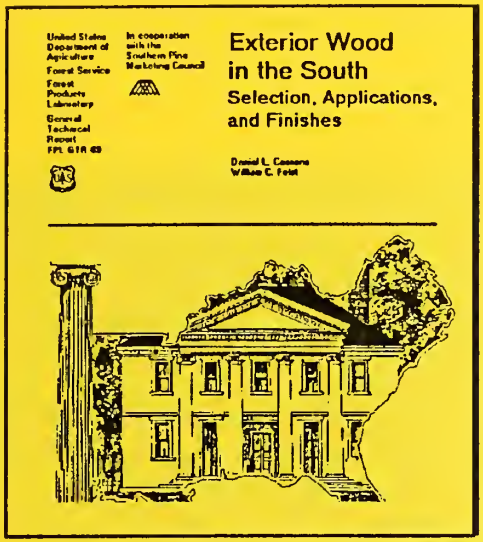
Microcomputers can facilitate information management and access. The National Wood Products Extension Program (NWPEP) has prepared four comprehensive textbases on the subject of wood finishing (*Finish, Southern, Chronicl, and Chronbib*), using one of the available commercial software packages (*IZE*). These are several of the textbases under development by NWPEP.

Recent major research publications are the basis of each textbase:

(***Finish***), Ag Handbook 647 "Finishing Wood Exteriors: Selection, Application and Maintenance";
Also included are two publications on the finishing and maintenance of wood floors: Oak Flooring Institute, Affiliate of National Oak



Included in the *'Finish'* textbase



Included in the *'Southern'* textbase

Flooring Manufacturers Association (NOFMA) "Hardwood Flooring Finishing/Refinishing Manual" and North Central Regional Extension Publ. 136 "Wood Finishing — Finishing and Maintaining Wood Floors".

(***Southern***), FPL-GTR-69 "Exterior Wood in the South: Selection, Applications, and Finishes";

(***Chronicl*** and ***Chronbib***), FPL-GTR-60 "Chronicle of 65 Years of Wood Finishing Research at the Forest Products Laboratory".

Accessing the Information

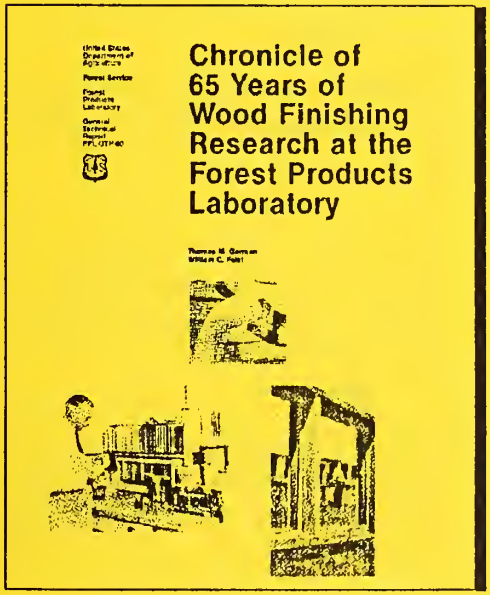
Extension professionals, point-of-sales staff, and other information providers can quickly and easily access these unique textbases on a PC-microcomputer. Text on a wood finishing subject can be retrieved using keyword, Boolean, or global searches.

USING THE INFORMATION

Not only can you retrieve and view the textbase information on the computer screen, but selected text can be printed, exported to an ASCII file, or reorganized for other uses.

For example, a phone inquiry about mildew control on a painted surface can be quickly answered following a rapid keyword search of the textbase by keying in 'mildew'. Information on the screen describes what mildew is and how it can be controlled – including the recipe for a wash solution.

A similar mail inquiry can be easily handled following the textbase search by exporting selected text to a response letter being composed in the PC word processor.



Included in *'Chronicl and Chronbib'* textbases

AVAILABILITY

Exterior Finishing Textbases

The Exterior Wood Finishing textbases are available from the **National Wood Products Extension Program** at no cost. The software program runs on IBM-compatible microcomputers with a hard disk drive. Please send two formatted 5.25-in. or one 3.5-in. double-sided/double-density disks with your request.

Commercial Software

The commercial software (*IZE)* is available with an educational discount in two versions from:

Retrieval Dynamics, Inc., 465 Science Drive, Madison, WI 53711; (608)273-8925.

IZE (ver. 2) is the standard package which allows you to develop and edit other textbases for searching and retrieving information . . . . . .$195.00.

IZE Reader is the **read-only** package which provides search and retrieval capability, but not the textbase development and editing capability . . . . . .$ 69.00.

The National Wood Products Extension Program (NWPEP) facilitates the transfer of wood products technology developed at the Forest Products Laboratory and elsewhere. Its key information network is the nationwide Cooperative Extension System. NWPEP strongly links Extension with important national wood products technology transfer efforts of the Forest Service, other federal and state agencies, and industry.

To request the *Finishing* textbases, contact the:

Nat'l. Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(608)231-9330

Cooperating :

Cooperative Extension System

Cooperative Extension Service
University of Wisconsin - Extension

USDA - Forest Service
Forest Products Laboratory

NWPEP

National Wood Products
Extension Program

Appendix 3.

Brochure — Using CD-ROM for Information Management

Using CD-ROM for

Information Management --

a vital key to

Rural Economic Development

Rural Economic Development
Rural Economic Development
Rural Economic Development

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN - EXTENSION

COOPERATIVE
EXTENSION SYSTEM

wood-based research

Information Source

The importance of *wood* as a unique, renewable, energy-efficient raw material continues to increase in the U.S. and abroad. Significant opportunities exist to improve the growing, harvesting and marketing of timber, the productivity and competitiveness of woodusing industries in rural America and the use of wood by consumers.

For over 80 years the U.S. Forest Products Laboratory (FPL) has been a world leader in all aspects of fundamental wood products research. FPL has helped extend the world's supply of wood through more efficient raw material use, through increased product longevity, and through creative product development. Wood products research information from FPL and other agencies and universities is available and needed to help revitalize America.

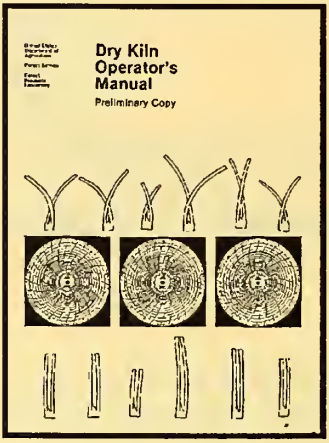
Information management (processing , accessing, and distribution is a vital key to Rural Economic Development.

wood-based research

Technology Transfer

The National Wood Products Extension Program (NWPEP), located at the FPL, facilitates the transfer of wood products technology developed at the FPL and elsewhere, through the nation-wide Cooperative Extension System. In this way, Extension is strongly linked with important national wood products technology transfer efforts of the Forest Service, other federal and state agencies, and industry.

One key NWPEP activity underway is the in-house development of a custom CD-ROM disc of FPL research-based wood information.



wood-based research

Information Processing

Staff of the National Wood Products Extension Program have indexed and tagged the full texts of 12 major FPL wood-based research publications for a custom disc. Graphics, tables, and photographs (including full-color) have been scanned and linked to the text using a commercial Windows-based search/retrieval software program.

CD-ROM Disc Development

CD-ROM technology offers the public an effective means for accessing wood research information . *Timely* access to current wood research information is fundamental to better timber resource use and to successful new product development amidst global competition.

CD-ROM in-house information disc development is now practicable and cost-effective for research institutions, such as the U.S. Forest Products Laboratory.

wood-based research

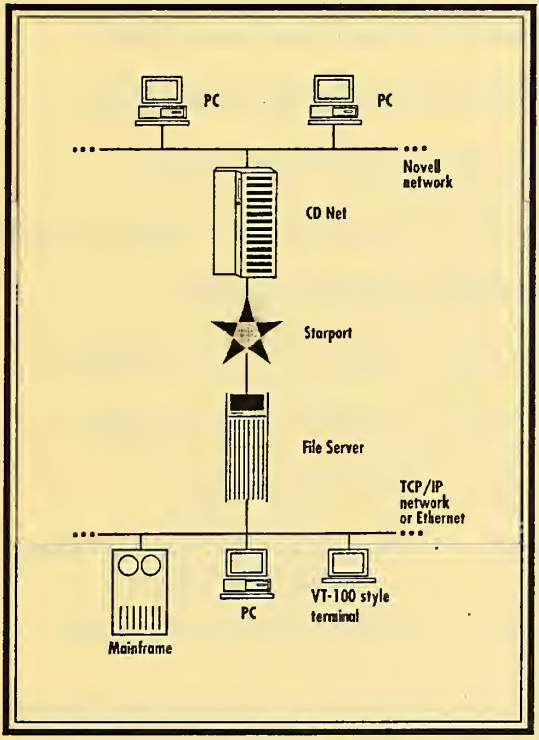
Information Access

CD-ROM disc players are available at reasonable cost for the large microcomputer user base. A fast, efficient information search and retrieval of very large databases is now possible for researchers, educators, businesses, and other clientele.

Each disc can store about 650 megabytes of information (text, graphics, and audio). For example, the entire set of 26 volumes of the Compton's Encyclopedia (Britannica Software) is on one disc, including full-text, audio, and full-color graphics!

wood-based research

Information Distribution



Comprehensive CD-ROM full-text databases can be searched at individual microcomputer workstations. Alternatively, a *library* of wood research information could also be accessed via CD-ROM disc network file servers.

The FPL *CD-ROM Custom Disc*
includes
12 major FPL Publications:

Ag Handbook 72– *Wood Handbook . . .*

Ag Handbook 73– *Wood-Frame House Construction*

Ag Handbook 101– *Wood: Colors and Kinds*

Ag Handbook 188– *Dry Kiln Operator's Manual*

Ag Handbook 402– *Air Drying of Lumber*

Ag Handbook 528– *Drying Eastern Hardwood Lumber*

Ag Handbook 531– *Storage of Lumber*

Ag Handbook 607– *Tropical Timbers of the World*

Ag Handbook 647– *Finishing Wood Exteriors . . .*

FPL-GTR- 57 – *Dry Kiln Schedules*

FPL-GTR- 60 – *Chronicle of 65 Years of Wood Finishing Research . . .*

FPL-GTR- 69 – *Exterior Wood in the South . . .*

National Wood Products Extension Program
Forest Products Laboratory, USDA-FS
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330

Appendix 4.

Selected *Extend* Newsletters

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER
Volume 3 July 1990

Revised Ag Handbook 73 now available

Wood Frame House Construction

In This Issue:

The latest edition of Wood-Frame House Construction, Agriculture Handbook 73, is now available and offers a how-to-guide for the experienced builder and the do-it-yourselfer. This 266-page manual can be a working guide to modern construction practices and techniques, a textbook, or a standard for judging house construction quality.

Completely rewritten in 1989, the book reflects major new advances in home building during the past decade. Its new features include a chapter on preconstruction and technical notes on concrete, treated wood, lumber and plywood grades, nail selection and use, heat flow, and insulation. Information on new materials and the use of manufactured components was added and the book's discussion of energy conservation practices was greatly expanded.

The manual begins by describing preconstruction considerations and a general schedule for completion. The next three chapters describe laying the groundwork, framing and closing in, and completing the shell. Chapter 5 discusses specialty items such as fireplaces, chimneys, porches, and driveways. The remaining chapters describe interior work, finishing touches, and special topics such as protection from decay and termites, noise control, and wind, snow, and seismic loads. The manual also contains an annotated bibliography and a glossary.

. . . a working guide to modern construction practices and techniques, a text book, or a standard for judging house construction quality . . .

This new edition draws upon the combined knowledge of industry and government to present the state of the art in wood home construction. The Research Center of the National Association of Home Builders and the USDA Forest Service, Forest Products Laboratory, jointly prepared the manual, with the cooperation of the Canadian Wood Council, National Forest Products Association, National Lumber and Building Materials Association, U.S. Department of Housing and

Continued on page 2

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION
USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY
COOPERATIVE EXTENSION
SYSTEM

Technology Advances in producing alcohols from wood

Alcohol Production

Both ethanol and methanol (types of alcohol suitable for fuel use) can be produced from wood. Yet only about 4 to 5 million gallons of alcohol are produced from wood each year in the United States, compared with almost 1 billion gallons of fuel alcohol produced from grains.

Current commercial biomass alcohol processes derive ethanol mainly from corn. Much of it is also produced synthetically from petroleum. Methanol is produced principally from natural gas, with a small contribution from coal. Wood-derived alcohol is produced from the waste liquor of a pulping operation.

. . . the two-stage, dilute sulfuric acid hydrolysis process converts wood to carbohydrates that can be fermented into alcohol.

Technology for ethanol production from wood has been developed and subjected to some pilot testing. The economic competitiveness of producing ethanol from wood depends on feedstock costs and other variables. Production and marketing of byproducts (high-fructose corn syrup and distiller's dry grains from corn and molasses and furfural from wood) significantly affect this economic balance. Ethanol production from wood could be implemented fairly rapidly, should another global petroleum emergency create the need for alternative fuels. However, some additional pilot testing of the technology may be needed.

The Forest Products Laboratory and the Tennessee Valley Authority's National Fertilizer Development Center have developed and pilot tested a process for producing ethanol from low-grade hardwoods. Called the two-stage, dilute sulfuric acid hydrolysis process, it converts wood to carbohydrates that can be fermented into alcohol. The second stage of two-stage hydrolysis produces about 20 kg of carbohydrates suitable for processing to ethanol from every 100 kg of ovendry wood feedstock. The first stage produces an additional 24.9 kg of carbohydrates, but many of these first-stage carbohydrates are not necessarily fermentable to ethanol.

If xylose could be fermented to ethanol economically, fermentation of the first-stage products, xylose and glucose, could nearly double ethanol production, compared with only fermenting the glucose from the second stage. Other possible products from the first-stage carbohydrates are single-cell protein, furfural, and feed molasses.

The technology for producing methanol from wood is less fully developed than that for producing ethanol. Although methanol was once produced from wood as a byproduct of charcoal manufacture, overall yields were low. To produce methanol from wood with a significantly higher yield would require production of synthesis gas in a process similar to that used for production of methanol from coal.

For additional information, contact:

John Zerbe, Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9353

Reference

Harris, John F., et al. 1985. Two-stage, dilute sulfuric acid hydrolysis of wood: an investigation of fundamentals. Gen. Tech. Rep. FPL-45. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 73 p.

(From FPL Techline)

House, *from page 1*

Urban Development, and many individual experts.

Copies are available from Department 36-GT, Superintendent of Documents, Government Printing Office, 710 N. Capitol Street, Washington, DC 20402-9325, (202)783-3238. Requests should include complete title, stock number, and prepayment (Wood-Frame House Construction, Agriculture Handbook 73, Stock number: 001-000-04547-4). Cost is $13.00 (subject to change).

(From FPL Press Release)

FPL Research Information Available

Publication Lists

The Forest Products Laboratory (FPL) conducts research on all aspects of conversion and use of the timber resource. This work has resulted in many technical reports, scientific articles, and USDA handbooks. To help the users of FPL research locate material pertinent to their interests, reports have been grouped into a series of FPL Publications Lists. Each list covers a major area of wood utilization research or several topics of interest to a particular audience. The 16 available lists and the subjects they cover are:

Biodeteriation and Protection of Wood

Stain, decay, fungi, durability, marine environments, termite control, preservatives and finishes, and corrosion.

Drying of Wood

Physical properties related to drying: Permeability, diffusion, and drying rate; shrinkage and swelling; moisture content; stresses. Lumber drying methods: Air drying, kiln drying, solar drying, special drying methods. Moisture content and temperature control during fabrication and use.

Energy from Wood

Liquid fuels, fuelwood, energy and chemicals from wood.

Exterior Wood Finishing

Finishing and durability, finishing research.

Fiber and Particle Products, Plywood, and Veneer

Wood and nonwood composites, particleboard, flakeboard, panel products, plywood, laminated veneer lumber, veneer peeling and processing.

Each list covers a major area of wood utilization research or several topics of interest to a particular audience . . .

Fire Safety

Performance of wood in fire, fire-retardant treatments, fire growth modeling.

Packaging

Corrugated fiberboard containers, cushioning, pallets, fasteners.

Sawing and Related Processes

Sawing; cutting and slicing; grades, specifications and standards.

Structure and Identification of Wood

Wood quality, wood properties, techniques, microstructure of wood, general wood structure.

Timber Requirements and Economics

Resource supplies and demands, processes, computer programs and methods.

Wood Bonding Systems

Types of adhesives and characteristics, gluing of wood, gluing of non-wood materials, durability of adhesives, laminated wood and glued assemblies.

Wood Chemistry

Analysis of wood and wood products. Chemical properties: Cellulose and hemicellulose, extractives. Conversion of wood: Biochemical, chemical; modified woods.

Wood Fiber

Pulp and paper biotechnology, paper testing, bleaching, recycling, interfiber bonding.

Architects, Engineers, Builders and Lumber Retailers

Buildings and structures, components, materials, joints and fastenings, moisture control and insulation, acoustics.

Furniture Manufacturers and Woodworkers

Physical and mechanical properties of wood, glues and gluing; wood preservation; drying and seasoning; finishing; sawing.

Continued on page 4

Lists, *from page 3*

Teachers of Industrial Arts and Vocational Education

Building materials, drying, economics, finishing and protection, fire-retardant treatments, glues and gluing, structures, wood properties.

Each entry in a Publication List provides the title, author, and date of the paper, and the source of the publication. Not all publications are available from the Forest Products Laboratory. Some are handled through public sales outlets such as the U.S. Government Printing Office or National Technical Information Service; others are handled by private publishers. In all cases, complete addresses for sources are given. Costs may be involved and are provided when known.

Single copies of any of the above Publication Lists are available from:

Information
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9200

(From FPL Techline)

Please Note

Your help is needed to maintain our mailing lists and to effectively assist you in your educational and technical assistance programs.
Note page 11! Fill in and return today. Your feedback is appreciated.

Forest Service Superior Science Award to Dr. Kirk

Award To FPL Scientist

Dr. T. Kent Kirk recently received the USDA Forest Service's Superior Science Award, the Agency's second highest scientific honor. Forest Service Chief F. Dale Robertson formally presented the award in Washington .

Kirk directs the Institute for Microbial and Biochemical Technology at the U.S. Forest Products Laboratory in Madison, Wisconsin. His award recognizes

. . . His research has set the stage for anticipated wide-scale industrial developments . . .

his management of the Institute and his research into how organisms break down the structure of wood. His research has set the stage for anticipated wide-scale industrial developments. These technologies include decolorization of the effluents from pulp bleaching plants, biochemical pulping, and the production of chemicals from lignin through biological means.

Kirk began his career at North Carolina State University and at Chalmers University of Technology in Goteborg, Sweden, before joining the Forest Service in 1970.

He is a fellow of the International Academy of Wood Science, a member of the National Academy of Sciences, and has received several major research prizes.

Kirk is the author of more than 140 publications, is an officer of the International Academy of Wood Science, and serves on the editorial boards of Enzyme and Microbial Technology and Wood Science and Technology.

The Forest Service makes its Distinguished Science Award and its Superior Science Awards annually, based on sustained research productivity, contributions of major impact on science or technology, scientific leadership, participation in professional societies and technology transfer activities, and other significant contributions.

(Debra Dietzman, FPL)

A Useful Working Tool for Dry Kiln Operators

Lumber Drying Schedules

A report issued by the USDA Forest Service's Forest Products Laboratory (FPL), Madison, Wisconsin, will be a handy reference tool for dry-kiln operators and others interested in kiln drying wood. *Dry Kiln Schedules for Commercial Woods -- Temperate and Tropical* contains dry kiln schedules for more than 500 commercial wood species.

Designed as a working tool, this publication would be especially useful for those who occasionally must process an unfamiliar species. Kiln schedules are completely written out, instead of being listed only in coded form (e.g. T2-D4).

. . . contains dry kiln schedules for more than 500 commercial wood species.

"Having each step of a schedule fully spelled out instead of abbreviated by code distinguishes this report from several previous publications," said Sidney Boone, FPL forest products research technologist and co-author of the report. Other co-authors are Charles J. Kozlik, Oregon State University (retired); Paul J. Bois, USDA Forest Service - State & Private Forestry (retired); and Eugene M. Wengert, Virginia Tech.

Most of the schedules are from the world literature with emphasis on U.S., Canadian, and British publications. *Dry Kiln Schedules* revises the recommendations of the *Dry Kiln Operators Manual* (Ag Handbook No. 188, 1961) for western U.S. and Canadian softwoods and for the U.S. southern pines. It also reflects current thinking on high-temperature (exceeding 212° F.) drying schedules for selected softwood and hardwood species.

The publication features both time-controlled schedules, often used for drying softwood lumber and construction products, and moisture-content-controlled schedules, used for drying furniture, millwork, and other products for which final moisture content is important.

The report's tables list the dry-bulb and wet-bulb temperature (in °F. and °C.), moisture content, equilibrium moisture content, and relative humidity for each step of a given schedule. Special kiln operating conditions are noted where appropriate.

The user can find the appropriate schedule for a given species and product through separate indexes based on geographic origin: United States and Canada; Latin America (Mexico and Central and South America); Asia and Oceania; Africa; and Europe.

The U.S. and Canadian index consists of two sections, conventional- or elevated-temperature schedules and high-temperature schedules. The index for conventional temperatures further distinguishes hardwood schedules, moisture-content-controlled schedules for softwoods, and time-controlled schedules for softwoods. All high-temperature schedules are time-controlled.

The indexes lead the user to appropriate schedules for several thicknesses of lumber and for specialty products such as squares, handle stock, and gunstock blanks. The indexes for Latin American, Asian and Oceanian, African, and European species list a British drying schedule in addition to the U.S. schedule.

. . . discusses equalizing and conditioning treatments to relieve drying stresses and the proper use of sample boards to monitor drying rate.

Appendixes cross-reference common trade and botanical names for native U.S. and Canadian species and for species not native to the U.S. and Canada.

Another *Dry Kiln Schedules* appendix briefly discusses equalizing and conditioning treatments to relieve drying stresses and the proper use of sample boards to monitor drying rate.

Continued on page 6

Lumber Drying, *from page 5*

Because the schedules in this report are intended only as general guidelines, users should have a reasonable level of experience in kiln operation. The suggested schedules should be finetuned to accommodate differences in kilns and wood property variations. For durability, the 158-page publication is bound in a water-resistant cover.

For a copy of General Technical Report FPL-GTR-57, *Dry Kiln Schedules for Commercial Woods -- Temperate and Tropical*, write or call: Information, Forest Products Laboratory, One Gifford Pinchot Dr., Madison, WI 53705-2398; (608) 231-9200.

(From FPL Press Release)

New Technology For Information Retrieval

Exterior Wood Finishing

PC users now have available software capabilities for full-text retrieval. NWPEP staff have prepared a comprehensive textbase on Exterior Finishing using Persoft IZE software. -1/ Other subject matter textbases are in preparation.

The Exterior Finishing textbase includes AH 647 "Wood Finishing: Selection, Application and Maintenance", FPL-GTR-60 "Chronicle of 65 Years of Wood Finishing Research at the Forest Products Laboratory", Bibliography of FPL-GTR-60 arranged alphabetically by author, "Outdoor Wood Weathering and Protection" - Chapter 16 of Wood Handbook (AH72), and "Chemistry of Weathering and Protection" - in Chemistry of Solid Wood. Advances in Chemistry Series 207. Also included is information on wood floors: "Hardwood Flooring/Refinishing Manual", and "Wood Finishing: Finishing and Maintaining Wood Floors".

This wealth of research-based information on disk can be searched by keyword, Boolean, or global searches to quickly retrieve information. Relevant information needed to develop program materials, media releases, or to answer inquiries can be visually scanned or downloaded to file or printer. You will be impressed with the power and utility of the textbase for your program use.

Interested? The Exterior Finishing textbase program is currently being field-tested by a number of specialists and extension agents. Information on the availability of the textbase will be announced in August.

-1/ Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FPL Research Conference

The USDA Forest Service's Forest Products Laboratory will host its annual Forest Products Research Conference on October 23-25 in Madison, Wisconsin. Each year's conference examines the role of forest products in aiding improved management and use of the timber resource and its importance in meeting domestic and international needs.

This year's theme, "Issues for the 90's: Challenges and Responses," will address many of the critical environmental, sociological, and technological impacts that the forestry community and the nation must deal with during the coming decade. Approximately 20 formal presentations in 4 half-day sessions will be complemented by a poster session, demonstrations, and a panel discussion on effective partnerships for the 90's.

Attendees will include researchers from the Forest Service, other governmental agencies, and Universities, State and Federal forest products marketing staff, Extension specialists and agents, State and Federal resource managers, and forest products industry representatives.

For registration information, please contact Diann Campbell (608) 231-9244; FTS 384-5244; DG address, D.Campbell:S32A.

Book Combines Chemistry and Archaeology of Wood

Archaeological Wood

Archaeological Wood: Properties, Chemistry and Preservation, brings the science of chemistry to the techniques of preserving archaeological wood. Edited by Roger Rowell of the USDA Forest Service, Forest Products Laboratory, and R. James Barbour of Forintek Canada Corporation, this newly issued book is the first to bring both disciplines to bear on the subject.

The discussion in this 17-chapter volume is based on knowledge of the structure of wood and the mechanisms of its degradation. It includes discussions on changes brought about by decay, biopredators, radiation curing, freeze drying, museum environments, the ethics of conservation, and value systems for choosing among the qualities of wood that can be preserved.

This 472-page book is published by the American Chemical Society as part of its Advances in Chemistry Series. Ordering information is available from the American Chemical Society, Distribution Office, Department 225, 1155 16th Street, NW, Washington, DC 20036, (800)227-5558.

(From FPL Press Release)

Urban "minimill" that recycles newsprint

Research Partnership

William D. Rinehart of the American Newspaper Publishers Association (ANPA) recently received a National Partnership Award from the USDA Forest Service. He was honored for his cooperation with the Forest Service's Forest Products Laboratory (FPL) in developing a newsprint recycling research program.

. . . could make newspaper recycling feasible near urban centers where newspapers are generated . . .

Rinehart, retired technical vice president for ANPA, established a research partnership to develop technology for a low-capital, urban "minimill" that recycles newsprint without using large quantities of water. In support of this concept, the FPL is studying newsprint forming techniques; the ANPA is conducting deinking research; and the Environmental Protection Agency's waste minimization branch is providing financial support.

This innovative approach could make newspaper recycling feasible near the urban centers where newspapers are generated, said Vance Setterholm, program manager for the Forest Service waste paper and wood waste management plan. Currently, newsprint must be shipped long distances to recycling mills located near water sources.

(From FPL Press Release)

"Bill Rinehart's fine efforts could result in better use of wood fiber and longer life for municipal landfills," Setterholm said. "This cooperative effort shows the great benefits that can come from partnerships."

Dale Robertson, Chief of the Forest Service, honored Rinehart and other National Partnership Award winners in a ceremony in Fairfax, Virinia.

(Debra Dietzman, FPL)

E-mail Anyone?

You may be surprised to find you have access to a little-known and under-utilized communications resource known as BITNET or INTERNET, an international electronic mail network. Through its gateways with other networks, it permits communication with almost all universities and research centers here and abroad.

To find out whether your university is connected to BITNET or INTERNET, contact your state Extension computer coordinator or university computer center. Access to the network at most land-grant universities requires a university mainframe computer account or a mailbox on Extension's E-mail system, a personal computer, communications software, a modem, and a phone line. Once connected to your E-mail system, there is no additional cost to send electronic mail anywhere in the world.

We would like to encourage the use of E-mail in our communications with you - but we need your BITNET OR INTERNET address! Please provide this and other information by returning p. 9 of this newletter.

From The Program Leader -

The National Wood Products Extension Program (NWPEP) is currently funded by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. In this way, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles will present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program stands ready to assist you.

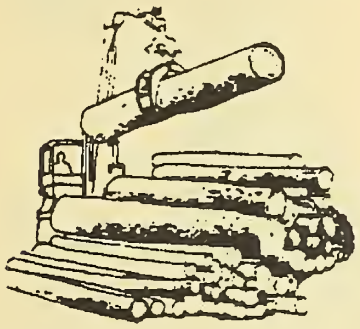
A number of other significant activities have been underway to develop Extension program materials and to provide cost-effective national electronic communication linkages for this collaborative wood products technology effort. Workshop and seminar training opportunities at FPL can be developed by NWPEP for Extension professionals. Let us know how we can be of further help.

Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330; FTS 384-5330; FAX (608)231-9592; EMAIL Peterson_T@WISPLAN.UWEX.WISC.EDU

Test procedures to measure current practices

Improve System



Researchers at the Forest Products Laboratory are developing a system called IMPROVE (*Integrated Mill Production and Recovery Options for Value and Efficiency*). It is a package of tools to measure and improve processing efficiency and product value and quality in sawmills, veneer mills, and plywood plants. Data collection procedures and computer software combine recovery improvement programs with many of the latest technological and research developments.

. . . eight major programs, each capable of evaluating specific processes in primary manufacture.

IMPROVE gives primary processors an easily used system to analyze how well logs are being converted to end products, identify opportunities to increase product yield and value, and predict the effects of proposed improvements.

The IMPROVE system consists of eight major programs, each capable of evaluating specific processes in primary manufacture. The eight areas being covered are log processing at the mill, green lumber manufacture, lumber drying, lumber dry end practices including planing, green veneer manufacture, veneer drying, plywood manufacture, and storage and shipping. Each of these programs basically consists of a test procedure to measure current practices and computer analysis to identify potential areas for improvement and to simulate the effects of changing practices.

Each of the IMPROVE major programs can be used independently, but the results of one program can also serve as input for the next. This permits tailoring an analysis to an individual mill's needs. Designed for use on an IBM or IBM-compatible personal

. . . a package of tools to measure and improve processing efficiency and product value and quality . . .

computer, each program consists of several routines that analyze various aspects of a given process. As with the programs, the routines can be used independently or in series.

Part of a multiyear research and development program, IMPROVE is a cooperative venture of the Research and State & Private branches of the USDA Forest Service, the USDA Extension System, and state foresters. A number of planned routines are now available for distribution. These include:

- Statistical quality control routines to analyze size control in lumber and veneer manufacture
- Log analysis routine to tally logs and enter them for use by other routines in the system
- Veneer analysis routines to identify opportunities to improve veneer yield and value
- Several routines to simulate log breakdown in sawmills and aid in mill operation and troubleshooting

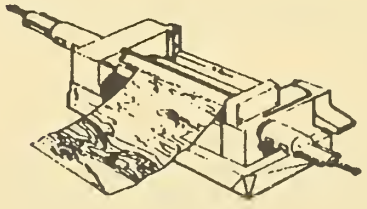
Eventually, the researchers expect to produce about 25 wood processing routines. Future issues of *EXTEND* will focus on specific IMPROVE routines.

Information on currently available software and documentation can be obtained by writing:

Stan Lunstrum
Forest Products Technologist
State & Private Forestry
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

For additional technical information, contact:

Jeanne D. Danielson
Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
608/231-9351



(From FPL Techline)

Knowledge important for consumer and woodworker safety

Fixation of CCA

Consumers readily accept wood products treated with chromated copper arsenate (CCA) because the water-borne treatment protects against decay and insects for a long time, leaves a clean, finishable surface and few use restrictions are necessary. Most experts believe CCA lumber (also known as pressure-treated or salt-treated lumber and by various trade names) that has been properly treated and conditioned is safe in use. By some estimates, one-third to one-half of all southern pine lumber is treated with CCA.

. . . one-third to one-half of all southern pine lumber is treated with CCA.

When the water-based, CCA-treating solution permeates the wood, the active chemicals undergo a series of reactions with and within the wood that greatly reduces the solubility of the CCA components. These reactions are temperature-dependent, virtually stopping at temperatures at and below freezing. Before the fixation reactions are complete, the preservative is susceptible to leaching and the potential for hazardous exposure of people to toxic chemicals is greatest.

Before the fixation reactions are complete, the preservative is susceptible to leaching . . .

Understanding how CCA chemicals become fixed in wood may allow researchers to predict other chemical preservative systems that will react similarly and perform reliably. Such understanding may also improve the current CCA system. Either approach expands the arsenal of tools for wood protection. Knowledge of fixation reactions also allows accurate determination of when preservative fixation is complete, an important consideration in consumer and woodworker safety.

In conjunction with an American Wood-Preservers' Association task force, scientists at the Forest Products Laboratory have developed a practical test that shows the completion of the chemical reduction of chromium, one indicator of fixation. Data are now being developed that should allow treated-wood producers to predict when their product will be ready to market. While outside the purview of the FPL, toxicological studies of CCA-treated wood are needed, and FPL could provide the technical liaison supporting such work.

For additional information, contact:
Daniel O. Foster, Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
608/231-9473

Reference:

Foster, D.O. 1989. Determination of the presence of hexavalent chromium in treated wood. AWPA Proceedings, in press.

(From FPL Techline)

Bob Mosdal joined the National Wood Products Extension Program (NWPEP) staff in March as an Information Processing Consultant. (This effectively doubled our current program staff!)

He will focus on adapting electronic communications media, including electronic mail, full text/graphics retrieval software and CD-ROM, to the technology transfer efforts of NWPEP. (See Exterior Wood Finishing article on page 6 for an example of work completed and underway.)

NWPEP development work is made possible through collaboration with the Forest Products Laboratory staff and a number of University of Wisconsin units, including the UW-Extension Communications Development Center (CDC), UW-Extension WISPLAN, Madison Academic Computing Center (MACC), and the North Central Computer Institute (NCCI).

Feedback Needed!

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know your specific needs within the NWPEP objectives (see p. 8). We will strive to be of assistance to you. ***Please return this page to us.***

1. Correct the address label if needed.

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5. Your training needs in the wood products areas:

6. Your wood products resource information needs for more effective programming:

Return this sheet to National Wood Products Extension Program, Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398

National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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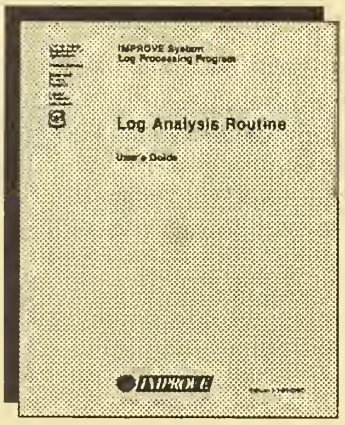
Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 3 August 1990

IMPROVE System Log Processing Program

Log Analysis Routine



In This Issue:

Increased competitiveness is a major U.S. industry necessity in our global economy. Sawmill and veneer mill owners and operators can benefit from better raw material inventory procedures and the fuller use of inventory data. The *Log Analysis* computer routine is designed to help collect, organize, and store information about logs.

Log Analysis can be adapted for buying and selling logs and for developing a program to maintain the yard inventory. From stored log information, calculations can be made of log volumes and scales, averages, overlength, and bucking accuracy.

Log Analysis can also serve as a front-end data source for other IMPROVE routines geared to increase mill efficiency and competitiveness. Why not also use the collected log data as input for conducting mill efficiency studies, e.g., determining the mill Lumber Recovery Factor (LRF)? Log data files can be used as input to the Best Opening Face (BOF) Sawing Simulation and Veneer Recovery Analysis routines.

When log grade information is also collected, *Log Analysis* can help analyze lumber grade yield in a sawmill, compared with published research grade yield data. Many other applications could be cited. The point is, log inventory data can and should be used by mill operators in a number of ways to increase process efficiency and competitiveness. *Log Analysis* is a ready-made, versatile tool to assist mill operators to do just that.

. . . is designed to help collect, organize, and store information about logs.

The main output of *Log Analysis* includes:

- log cubic volume by Smalian's, Huber's, or Newton's formulas
- log scale by Doyle, Scribner, Bureau Scribner, or International 1/4 or 1/8-inch rules
- bark volume
- average log overlength or underlength
- log size summary table
- log cubic volume summary
- log scale summary
- log length frequency distribution
- other data input summaries, e.g., log grades and other classifications

Continued on page 5

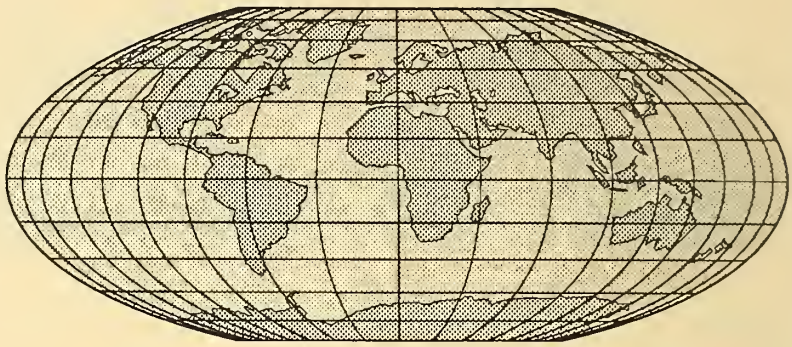
COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

Lindell Chairs ITTO Committee

Tropical Forests



The International Tropical Timber Organization has named Gary Lindell as the 1990 chairperson of its Forest Industry Committee. Lindell directs the International Forest Products Program at the U.S. Department of Agriculture- Forest Service's Forest Products Laboratory.

Lindell is the first U.S. citizen to head the Forest Industry committee.

ITTO, a United Nations-sponsored organization, supports development of tropical timber trade and wise use and conservation of tropical forest resources. Through ITTO activities, its 43-member countries seek to improve market intelligence; assist reforestation, forest management, and timber processing in producing countries; and support research and development toward these ends.

Lindell is the first U.S. citizen to head the Forest Industry committee. The committee sponsors projects such as a timber development seminar this last spring in Ghana and a study by British researchers of incentives for sustainable development of tropical forests.

Before heading the international efforts of the FPL, Lindell served as assistant director for planning and application from 1979-1983 and assistant director for processing and protection research from 1983-88.

Lindell joined the Forest Service in 1960 and has worked for the Wayne-Hoosier National Forest, Northeast Forest Experiment Station, North Central Forest Experiment Station, Washington Office, and Pacific Northwest Experiment Station. He also spent three years as a forestry officer with the Forestry Department of the Food and Agriculture Organization (FAO) in Rome.

(From FPL Press Release)

Plywood Mill Analysis Program

Plymap

Changing technology, together with cost fluctuations (primarily in wood prices), continually alter the economic equilibrium of plywood mills. To help evaluate the economic effects of changes, economists at the Forest Products Laboratory developed a computer simulation model of plywood processing called *PLYMAP* (Plywood Mill Analysis Program). This model assesses the net economic effect of changing process parameters in a plywood mill and aids in mill layout and design.

Specifically, *PLYMAP* analyzes plywood processing by 12 work centers. For each center, the model calculates machine utilization based on user-specified performance parameter values that define the technology at each center and the size and volume of wood processed. The user can adjust parameter assumptions to achieve a balanced material flow. By specifying representative parameters for each work center, the user can gauge the adequacy of the mill layout and identify bottlenecks for given technology and wood input conditions.

. . . the user can determine the conditions that maximize mill efficiency and profitability . . .

The user also specifies labor, material and energy requirements, and unit costs which the program uses to calculate overall mill production costs. By simulating a range of wood input sizes and technology conditions, the user can determine the conditions that maximize mill efficiency and profitability.

PLYMAP is written in FORTRAN and designed to be run interactively on any IBM or compatible personal

Continued on page 3

Key To Future Pulp And Paper Manufacture

Biotechnology

Fungi and their ability to degrade wood are opening new ways to make paper and related products. Biotechnology may soon permit us to pulp wood with less energy, bleach pulps without chemicals, use more recycled fiber, and ferment papermaking by-products to fuel alcohol, says T. Kent Kirk, director of the Institute for Microbial and Biochemical Technology at the USDA Forest Service, Forest Products Laboratory, Madison, WI.

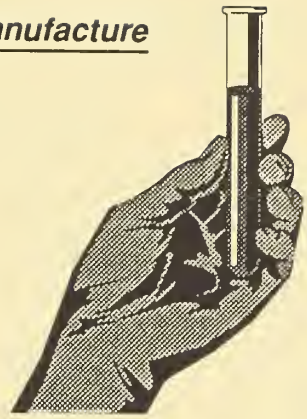
Kirk and other scientists in labs around the world are applying microbial and enzyme technology to the commercial processes of pulp and paper manufacture and to the basic science of how the useful fungi work.

. . . may soon permit us to pulp wood with less energy.

Biotechnology opens new approaches because it takes wood apart by breaking selected chemical bonds within or between wood cells. This is an attractive approach because enzymes catalyze only very specific reactions and by-products are natural and less harmful to the environment than chemical by-products. In addition, using biotechnology can cost less than traditional processes.

In a presentation to the national meeting of the American Association for the Advancement of Science, Kirk outlined four possible roles for biotechnology in pulp and paper manufacture.

The first is *biopulping*, the use of fungi in primary in primary pulp manufacture. In biopulping, fungal pretreatment softens wood chips before they are ground to pulp. Research at the Forest Products Laboratory and University of Wisconsin has shown that such pretreatment saves energy and produces stronger pulps.



Biopulping seems promising enough commercially that 20 pulp, paper, and related companies have joined the Forest Products Laboratory and the University of Wisconsin Biotechnology Center in a consortium to investigate the process.

In another role, biotechnology could *modify pulp and recycyled fiber.* Enzymes could replace chemicals in pulp bleaching, a process that now uses chlorine and generates dioxin and other chlorinated aromatics. Enzymes could also be used to change surface properties, flexibility, and other characteristics of a wood fiber so that it bonds with other fibers more readily. Whole living fungi could potentially be grown directly in pulp to improve strength and other properties. Enzyme treatments could solve some problems unique to recycled fibers such as removing ink, starch, and clay coatings applied to papers. However, little research on these applications has been done to date, Kirk says.

. . . could modify pulp and recycled fiber.

Treatment of effluents from conventional chlorine bleaching of chemical pulps is a third potential role for biotechnology. These effluents represent perhaps the most serious environmental problem created by the pulp and paper industry.

Fortunately, early research results on effluent problems have shown signs of success. In a small pilot plant run at a kraft mill in Sweden, anaerobic and aerobic biological treatments, in combination with ultrafiltration, reduced biological oxygen demand 95 percent, organically bound chlorine 80 percent, and color by 50 percent.

Continued on page 4

PLYMAP, *from page 2*

computer. The program is command driven, which means it prompts the user to supply answers to a set of questions before proceeding with calculations. The program is suited to most rotary-peeled plywood operations.

For additional information, contact:

Henry Spelter, Economist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608) 231-9380

For a copy of General Technical Report FPL-GTR-65, *PLYMAP - A Computer Simulation Model of Plywood Production,* write or call Information, Forest Products Laboratory, One Gifford Pinchot Dr., Madison, WI 53705-2398; (608) 231-9200.

(From FPL Techline)

To enhance the industry competitive position

Technical Center

A furniture manufacturer needs to locate suppliers of computer-numerically controlled (CNC) woodworking machinery; a forest products technologist needs current research results to assist in technology transfer efforts; a wood products manufacturer needs to locate information contained in a specific research publication. To meet these and similar needs, the USDA Forest Service established the Advanced Hardwood Processing and Technical Resource Center at Princeton, West Virginia. Its staff can access many commercial databases on completed and current research in wood processing and have developed their own specialized databases on various types of machinery, manufacturers, and dealers. The Center is part of the Forest Service's Northeastern Forest Experiment Station.

. . . a source of information on the processing of hardwoods . . .

The Center supplies information needed to effectively use the substantial U.S. hardwood resource. These trees, which can vary greatly in quality, represent significant potential value. Manufacturing these variable-quality hardwoods into furniture, millwork, and other products creates substantial value-added economic opportunities. Using cost-efficient equipment and applying new technology to the processing of these hardwoods can enhance the competitive position of the United States wood processing industry.

Designed to serve the public as a source of information on the processing of hardwoods, the Center works like this. An individual with a question or concern contacts the Center via phone, mail, or FAX. The Center staff searches the databases and literature and provides the caller with the requested information. The caller may also be referred to a specialist in a particular field for answers to specific questions. There is no charge for this service.

The Center is staffed from 8:00 a.m. to 4:30 p.m. (Eastern time), Monday through Friday. Callers may leave a message with the telephone answering service at other times.

For additional information, contact:
Robert L. Brisbin, Research Forest Products Technologist
USDA Forest Service
Advanced Hardwood Processing and Technical Resource Center
R. 2, Box 562-B
Princeton, WV 24740
(304) 425-6945; FAX (304) 425-1476

(From FPL Techline)

Biotechnology, *from page 3*

By-product bioconversion is a fourth role for biotechnology and one where many commercial applications already exist. Microbial protein (primarily yeast) has long been produced commercially from spent sulfite liquors from papermaking. Bioconversion received much attention during the oil crisis of the 1970s because of its potential for making alcohol-enriched fuels.

However, the by-products of hardwood tree species used to make paper present a different challenge. Much of the sugar from hardwoods is the 5-carbon sugar xylose, for which no commercial fermentation technology exists. Although the need for xylose fermentation techniques is recognized, research progress has been slow.

An unexplored avenue of research is the bioconversion of by-product lignins to chemicals or to more reactive polymers.

Continued development of biotechnology requires certain fundamental knowledge. Especially critical are an understanding of the separate enzyme systems that degrade lignin and cellulose. (Cellulose is a primary component of wood cell walls and lignin is the gluelike substance that binds the cellulose and the cells together.)

. . . industry must be aware of the potential of biotechnology and of research results, and be able to implement them.

The key to further progress in the use of biotechnology in pulp and paper manufacture is communication between researchers and industrial technical experts, Kirk says. In order to profit from this new field, industry must be aware of the potential of biotechnology and of research results, and be able to implement them.

For more information contact:

Dr. T. Kent Kirk
Project Leader
Forest Service, USDA
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9466

(From FPL Press Release)

Feedback !

Is your mailing label correct? Please return p. 11 of this issue of *EXTEND* so that we may better serve your needs. Thanks.

Performance of FRT Wood Under High Temperatures

Fire-Retardant Wood

Building codes and insurance companies permit fire-retardant-treated (FRT) wood to be used in structures as an alternative to noncombustible materials. However, under some rather specific circumstances, fire-retardant-treated plywood used as roof sheathing has weakened significantly. The problem, most common in the eastern United States, has sometimes required costly roof replacement.

The very reaction that makes fire retardants effective also causes them to degrade the wood.

Researchers at the Forest Products Laboratory are beginning to understand the origin of the problem. The very reaction that makes fire retardants effective also causes them to degrade the wood. The combination of elevated roof temperatures caused by solar radiation, chemicals, and moisture can prematurely activate the fire retardant to do what it is designed to do: lower the temperature at which thermal degradation occurs. This causes the wood to become dark and brittle and to crumble easily.

Researchers at the Forest Products Laboratory are researching variables that influence such strength degradation. The variables include fire-retardant formulation, temperature, and moisture content of the wood.

In initial tests, specimens were treated with fire-retardant chemicals, kiln dried, exposed to elevated temperatures for different durations, and then tested by static bending procedures. After 160 days of constant exposure to temperatures of 180 degrees Fahrenheit, most fire-retardant chemicals caused significant reductions in strength properties; at temperatures of 130 degrees Fahrenheit, strength reductions for most chemicals were not significant.

FPL has published a report that provides guidelines to architects, design engineers, builders, and others who must be aware of the potential problem. *Choosing and Applying Fire-Retardant-Treated Plywood and Lumber for Roof Designs,* FPL-GTR-62, describes what is known about FRT plywood and the variables suspected of contributing to its strength degradation. It also discusses the research in progress and provides guidelines on the selection and use of FRT plywood in the design of roof systems.

FPL has published a report that provides guidelines to architects, design engineers, builders, and others . . .

A recent paper presents a review of the pertinent literature on the factors influencing strength reduction in treated wood. These factors are the thermal degradation process of wood, the mechanism by which fire retardant chemicals alter wood degradation, the effects of acids on wood strength, the influence of temperature on strength, and the combined effect of fire retardant chemicals and temperature on strength.

Reference:

LeVan, S.L.; Winandy, J.E. 1990. *Effects of Fire Retardant Treatments on Wood Strength: A Review. Wood and Fiber Science, 22(1):113-131.*

Copies of the FPL report and reprint are available from the Information Group, Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398, (608) 231-9200.

For additional information, contact:

Susan L. LeVan
Chemical Engineer
USDA Forest Service
Forest Products Laboratory

(From FPL Techline)

Log Analysis, *from page 1*

Log Analysis is a compiled program that will run on an IBM or compatible microcomputer with at least 256K of RAM. A hard disk is highly recommended. The software program is available from the Forest Service. Requests should be accompanied by (a) computer name and (b) one 5 1/4 or 3 1/2-inch double-sided, double-density disk.

Send your request to:

State & Private Forestry
USDA, Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

Weathering of Wood Affects Paint Performance

Prefinish Weathering

The reasons for premature and catastrophic peeling of paint from wood are often difficult to determine. Researchers at the Forest Products Laboratory (FPL) are investigating several aspects of this problem. They recently determined that paint applied to weathered wood surfaces has decreased adhesive strength. Weathering for periods as short as 2 to 4 weeks before finishing caused significant losses of paint adhesion.

. . . more consideration should be given to using wood products that are factory prefinished or preprimed . . .

Such deterioration could lead to premature paint failure and means that wood should be finished as soon as possible when it is installed outdoors. If not protected by appropriate paints, stains, or other pigmented finishes, poor finish performance might result. The research results also suggest that more consideration should be given to using wood products that are factory prefinished or preprimed, as is the case with commercial hardboard products.

Weathering of building materials before finishing can lead to premature paint failure.

These basic results were already published in scientific journals. Research is continuing and will include the long-term effects of weathering on the performance of wood finishes and how different wood species respond to weathering. Results to date demonstrate for painters, contractors, and architects the importance of protecting wood from the weather before it is finished in order to ensure long life for the applied finish.

For additional information, contact:

R. Sam Williams
Research Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9412

(From FPL Press Release)

References

Williams, R.S.; Winandy, J.E.; Feist, W.C. 1987. *Paint adhesion to weathered wood.* J. of Coatings Technology 59(749):43-49.

Williams, R.S.; Winandy, J.E.; Feist, W.C. 1987. *Adhesion of paint to weathered wood.* Forest Products Journal 37(11/12):29-31.

Feist, W.C. 1987. *Finishing of wood.* In: Wood Handbook: Wood as an engineering material. Agric. Handb. 72, rev. Washington, DC: USDA. Chapter 16. (Complete book available from Superintendent of Documents, U.S. Gov't. Printing Office, 710 N. Capitol Street, Washington, DC 20402)

Timber Bridge Program

In 1989, the USDA Forest Service began a program to respond to the renewed interest in using timber as a construction material for bridges. Timber bridges offer an economical, durable, safe, and attractive alternative to traditional materials used for bridge construction. Timber bridges are of growing interest because they are economically competitive with other materials and designs, perform well, and are easy to construct and install.

The Forest Service initiative established a Timber Bridge Information Resource Center for technical assistance, funded cost-share demonstration bridges, and expanded timber bridge research. The Center's program is to inform state, county, and local officials, federal agencies, engineers, and contractors about the advantages of using properly treated timber for new and replacement bridges on local and secondary road systems and public properties. The Center also administers the selection and installation of the demonstration bridges.

Through cost-share funding, at least 80 bridges will be constructed nationwide to demonstrate modern timber design concepts. The demonstration bridges emphasize the utilization of native species to stimulate local employment and rural economics.

Performance data from some of these demonstration bridges will be used to obtain approval of new designs from the American Association of State Highway Transportation Officials (AASHTO). Existing AASHTO standards will also be refined to reflect current timber bridge technologies, such as crash-tested guardrail designs and timber from species not formerly used.

This stressed-deck bridge was installed as a demonstration of new timber bridge technology.

AASHTO design standards are recognized nationally and keep transportation systems uniform. They are usually a basis for funding approval by the Federal Highway Administration and state transportation agencies. AASHTO approval of new timber bridge technologies is necessary if timber is to be a viable alternative in many locations, because local projects often receive partial funding from federal or state agencies.

Research is continuing to refine some of the newest designs and develop recommended design criteria. (*Note reference cited.*) Studies are also being conducted to optimize species availability, treatability, and performance. Researchers are developing and crash testing guardrail designs to provide standard systems that comply with recommended AASHTO guidelines for crashworthy railings. Economic studies are being conducted to better compare the costs of alternative materials and to calculate life cycle costs, including initial costs, maintenance, and longevity.

For additional information, contact:

John B. Crist, Program Manager
Timber Bridge Information Resource Center
USDA Forestry Sciences Lab
180 Canfield Street
Morgantown, WV 26501
(304)291-4159

(From FPL Techline)

Reference

Oliva, M.G.; Dimakis, A.G.; Ritter, M.A.; Tuomi, R.L.. 1990. *Stress-laminated wood bridge decks: experimental and analytical evaluations.* Res. Pap. FPL-RP-495. Madison, WI: U.S.D.A., Forest Service, Forest Products Laboratory. 24 p.

From The Program Leader -

The National Wood Products Extension Program (NWPEP) is currently funded as a 3-year special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. In this way, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program stands ready to assist you.

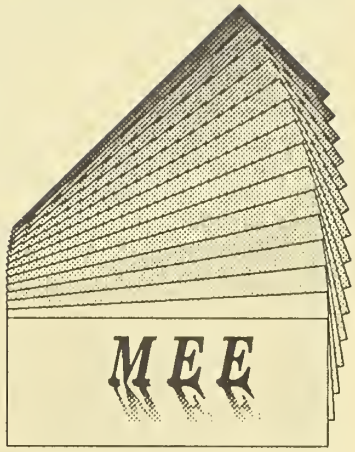
Significant developments are underway to develop full-text retrieval microcomputer textbases on major wood products subjects. The first completed package is on *Exterior Wood Finishing*. We strongly promote the use of E-mail as a cost-effective national electronic communications linkage among Extension professionals at land-grant institutions and even world-wide. (Do you have your E-mail address and have you returned this information? See p. 11.) A CD-ROM disc of major FPL wood products research publications and handbooks, including graphics and colored photos, is under development, in cooperation with the Forest Products Laboratory. Workshop and seminar training opportunities at FPL can be developed by NWPEP for Extension professionals. Let us know how we can be of help to you.

Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330; FTS 384-5330; FAX (608)231-9592; EMAIL Peterson_T@WISPLAN.UWEX.WISC.EDU

Wood is always affected by moisture

Protecting Wood From Humidity



Whether indoors or outdoors, wood is always affected by moisture. Wood swells when it gets wet and shrinks as it dries, whether the moisture is liquid water like rain or dew or just high humidity. But, wood coated with the right finishes will be less affected than wood left completely unfinished.

Tests conducted at the Forest Products Laboratory (FPL) on the moisture-excluding effectiveness (MEE) on wood surfaces show that no coating applied on wood entirely prevents it from picking up moisture in high humidity or giving off moisture in low humidity. Researchers did find that the MEE of wood finishes varied greatly. Some were very good to excellent, some were poor, and many were in-between. Best effectiveness was found when three coats of finish were applied to the wood surface.

Several factors determine how effective a finish will be in controlling moisture. One is *film thickness*. Generally, the more coats applied, the slower the moisture changes and the greater the protection. A second factor is the *type of finish used*. Pigmented coatings such as oil-based paints are usually more effective in retarding moisture changes than clear coatings such as varnishes and shellacs. A third factor is *time*. Even good coatings lose their effectiveness over time. The longer the exposure, the lower the effectiveness. Finally, finishes will protect wood from moisture only when *applied evenly to all wood surfaces*. Unequal coatings on the surfaces of a wood piece may cause unequal shrinkage and lead to warp.

Controlling moisture is very important in using wood indoors as well as outdoors.

Controlling moisture is very important in using wood indoors as well as outdoors. The information developed on moisture exclusion should be helpful in determining which finish should be used for a particular need. This information is particularly valuable to furniture finishers or to anyone wishing to protect wood from high or low humidity.

Moisture-excluding effectiveness (MEE) of wood finishes (3 coats after 14 days at 90% relative humidity)

Finish	MEE
Melted paraffin wax (one-coat dipped)	95
Two-component epoxy/polyamide gloss paint	87
Aluminum-pigmented polyurethane gloss varnish	84
Soya-tung alkyd satin enamel	80
Pigmented flat shellac	73
Two-component polyurethane wood sealer	63
Orange or white shellac	46
Phenolic/tung floor sealer	35
Paste wax	1
Linseed oil	0

References

Feist, W.C.; Little, J.K.; Wennesheimer, J.M. 1985. *The moisture-excluding effectiveness of finishes on wood surfaces.* Res. Pap. FPL-462. Madison, WI: USDA Forest Service, Forest Products Laboratory.

Feist, W.C.; Little, J.K.; Wennesheimer, J.M. 1985. *The moisture-excluding effectiveness of finishes on wood surfaces -- support data.* Madison, WI: USDA Forest Service, Forest Products Laboratory. *(Available from the National Technical Information Service (NTIS), U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, VA 22161)*

Feist, W.C.; Peterson, G. 1987. *Protecting wood from humidity.* Fine Woodworking 64(May/June): 59-61.

For additional information, contact:

William C. Feist
Project Leader and
Research Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9497

Eliminates veneer buckling in drying

Modular Veneer Press Dryer

Almost all face veneer looks good when cut, but much of it becomes wavy, wrinkled, and brittle in the dryer. A severe kind of wrinkling called buckling sometimes occurs, caused by uneven drying and shrinkage of the veneer. The problem is worse with veneer containing tension wood and juvenile wood, which is more prone to longitudinal shrinkage. Yet, these problem woods are appearing more frequently in logs used by veneer producers.

Fortunately, the problem can be eliminated by holding the veneer flat as it dries. This can be done in a press, but face veneer is so thin (1/32 in. or less) that it starts to dry before the press closes. In addition, applying light and uniform pressure is difficult with press plates that may not be perfectly flat themselves.

A solution is the modular veneer press (MVP) dryer developed at the Forest Products Laboratory (FPL). The modular veneer press dryer combines the continuous operation of a hot-air dryer with the restraint of a platen press dryer. It dries veneer by direct contact with rotating heated drums arranged in series.

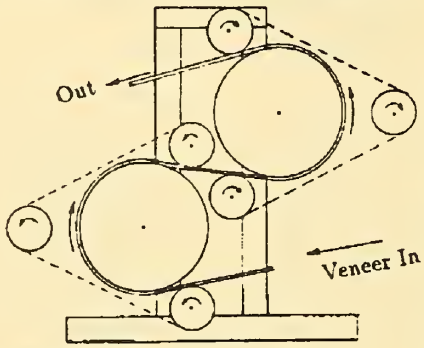
Veneer dried by the MVP dryer was significantly flatter than that dried by a commercial jet dryer.

Each drum has an endless flexible belt arranged so that the belt wraps halfway around the drum. The veneer is heated on opposite sides by successive drums. The belt holds the veneer tightly against each drum at a typical pressure of 2 lb/in².

Veneer dried by the MVP dryer was significantly flatter than that dried by a commercial jet dryer. The MVP-dried veneer also shrank less in width, but more in thickness than the jet-dried veneer. Thickness shrinkage with the MVP was less than with a platen press dryer or roller dryer.

Researchers at FPL arranged a drying test with Freeman Corp. in Winchester, Kentucky, to compare the performance of the MVP dryer with their jet dryer. Because the value of buckled veneer is 15 to 20 percent less than that of flat veneer, buckling costs them an estimated $45,000 to $60,000 per month.

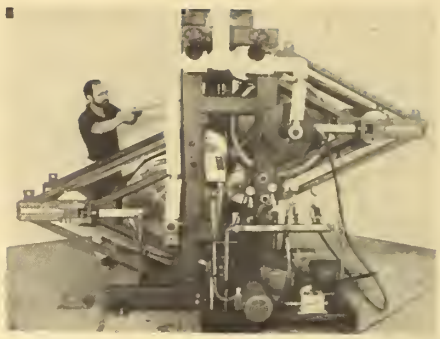
Implementation of this technology could improve veneer quality . . .



Path of veneer in dryer.

Matching test pieces were dried in the Freeman Corp. dryer and in the MVP dryer at FPL, then compared for shrinkage and flatness. The most significant result was the improvement in flatness for the MVP-dried veneer.

The MVP dryer also showed promise for flattening veneer that had buckled in the jet dryer. The veneer was steamed between wet canvas



Modular veneer press dryer.

during one pass through the MVP dryer and redried during a second pass. No evidence of buckling remained after redrying.

Currently, the FPL is seeking an industrial partner to develop a commercial-scale version of the MVP dryer. Implementation of this technology could improve veneer quality and open the door to making quality veneers from difficult species.

For additional information, contact:

Steve Loehnertz
Research Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9349

References

Loehnertz, S.P. 1988. *A continuous press dryer for veneer.* Forest Prod. J. 38(9):61-63.

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(From FPL Techline)

Feedback Still Needed

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know your specific needs within the NWPEP objectives (see p. 8). We will strive to be of assistance to you. *Please return this page to us.*

1. Correct the address label if needed.

2. Indicate your E-mail address (note sidebar item):

_____

3. Indicate your FAX #:

_____

4. Note your training needs in the wood products areas:

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5. Note your wood products resource information needs for more effective programming:

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Promoting the Use of E-mail

You may be surprised to find you have access to a little-known and under-utilized communications resource known as BITNET or INTERNET, an international electronic mail network. Through its gateways with other networks, it permits communication with almost all universities and research centers here and abroad.

To find out whether your university is connected to BITNET or INTERNET, contact your state Extension computer coordinator or university computer center. Access to the network at most land-grant universities requires a university mainframe computer account or a mailbox on Extension's E-mail system, a personal computer, communications software, a modem and a phone line. Once connected to your E-mail system, there is no additional cost to send electronic mail anywhere in the world.

We would like to encourage the use of E-mail in our communications with you and distributing information to you - but we need your BITNET or INTERNET address! If you do not have one, get one.

Please send your E-mail address and other information on the adjacent form to:

National Wood Products
Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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FPL Research Conference

October 23-25, 1990

The USDA Forest Service's Forest Products Laboratory will host its annual Forest Products Research Conference on October 23-25 in Madison, WI. Each year's conference examines the role of forest products in aiding improved management and use of the timber resource and its importance in meeting domestic and international needs.

This year's theme, *"Issues for the 90's: Challenges and Responses"*, will address many of the critical environmental, sociological, and technological impacts that the forestry community and the nation must deal with during the coming decade. Approximately 20 formal presentations in 4 half-day sessions will be complemented by a poster session, demonstrations, and a panel discussion on effective partnerships for the 90's.

Attendees will include researchers from the Forest Service, other governmental agencies, and Universities, State and Federal forest products marketing staff, Extension specialists and agents, State and Federal resource managers, and forest products industry representatives.

For registration information, please contact Diann Campbell (608)231-9244: FTS 384-5244; DG address, D.Campbell:S32A .

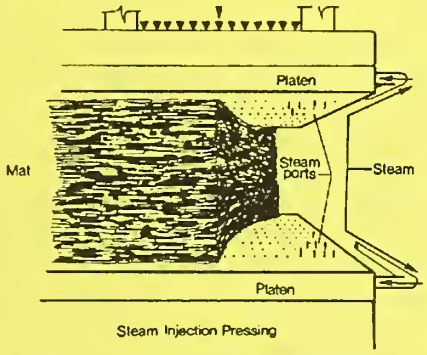
Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 3 September/October 1990

Promising process for fiberboard production

Steam Injection Pressing

Researchers at the Forest Products Laboratory have developed a new process that dramatically reduces the resin-curing time needed in manufacturing wood composite products. The 45 minutes needed to conventionally press a 2-inch-thick flakebaoard is reduced to less than 5 minutes with steam injection. The process works by injecting saturated steam into a wood composite mat during pressing. In addition to saving time, steam injection pressing makes the production of thick boards possible.



Saturated steam is injected into the mat through top and bottom perforated platens during press closure.

The process begins when resin-coated particles are formed into a mat and loaded into a press. As the board is compacted, a burst of saturated steam is injected into it through perforated platens. Within several seconds, the temperature in the board's center rises to between 280° and 315°F. This high temperature accelerates the curing of the resin. The relationship between time and press conditions are critical, so the process must be controlled by a computer. Process modification allows production of particleboard and fiberboard, in addition to flakeboard.

The new process uses smaller equipment and less energy . . .

This technology has been applied commercially and has even created panels more than 3 inches thick using large presses. The availability of these thick panels fabricated with specific properties offers architects, engineers, and product designers new opportunities. Possible applications range from large structural members to furniture parts turned on a lath.

For additional information, contact:

Robert L. Geimer
Research Technologist
Forest Products Lab
One Gifford Pinchot Dr.
Madison, WI 53705-2398
(608)231-9395

(From FPL Techline)

In This Issue:

References

Continued on page 5

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

FOREST/ENERGY Newsletter

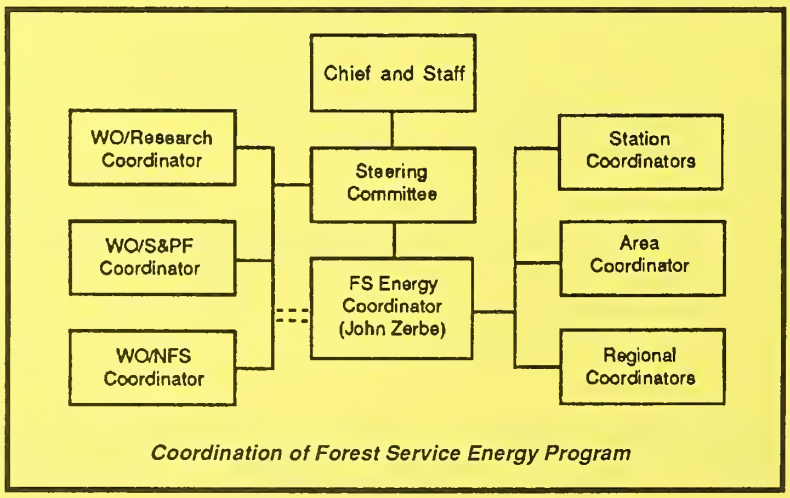
A new Forest Service energy newsletter about the use of wood for energy and energy conservation in forestry and forest products applications began publication in May 1989. Titled "Forest/ Energy News," it succeeds a similar newsletter, QUADS, which was published from 1978 to 1986. The new name was chosen to clearly convey the publication's scope to its readers.

"Forest/Energy News" is distributed electronically, but a small number of hard copies are also produced. Its content focuses on energy within the Forest Service, but also covers developments in both the public and private sectors that can influence use of wood for energy. Comments and contributed articles are welcome and should be sent to the Energy Coordinator at the address listed below.

The newsletter responds to a March 1989 Forest Service action plan for expanding the contribution of wood to national energy goals. The plan calls for more awareness of energy opportunities so that the Forest Service can respond to growing needs for energy from wood and any changes in an increasingly import-dependent U.S. oil supply.

The main purpose of the action plan is to improve the visibility of energy activities of the Forest Service. Besides the newsletter, the action plan includes efforts to organize a Forest Service steering committee, energy coordinators, and a Federal Interagency Energy Committee.

The Forest Service energy program will also produce and circulate case studies of successful energy projects, develop proposals for National Forest System sales policies and obtain outside input on establishing research priorities. Other activities will include expanding the utilization of wood for energy and comparing the air quality effects of burning wood with the effects of fossil fuels or alternatives such as nuclear.



Coordination of Forest Service Energy Program

Closer coordination of Forest Service energy efforts will maintain awareness of new developments in wood for energy, establish a focal point for energy information and activities, and facilitate coordination with others, particularly the Department of Energy.

For additional information, contact:

John Zerbe
Forest Service Energy Coordinator
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9353

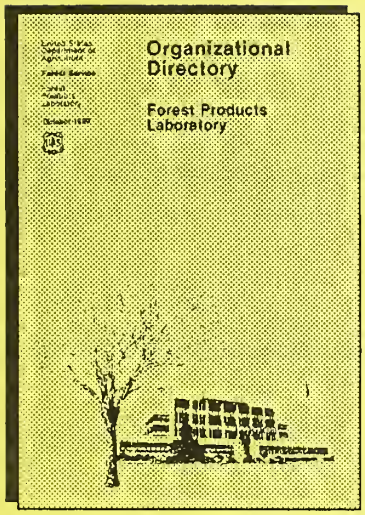
(From FPL Techline)

TT Opportunity

Although the "Forest/Energy News" was initiated to improve internal communications about Forest Service energy activities, Extension professionals and other agency staff can benefit from the newsletter information.

Plans are underway to expand the newsletter distribution to people not on the Forest Service DG computer network. Hopefully, "Forest/Energy News" can soon be downloaded from the Public Bulletin Board of the UW-Extension WISPLAN computer. In the meantime, if you wish to receive a copy of this newsletter, contact the National Wood Products Extension Program (see p. 8 for address and contact numbers).

This wider distribution can augment the coordination and effectivness of the Forest Service Energy action plan.



Directories

Directories

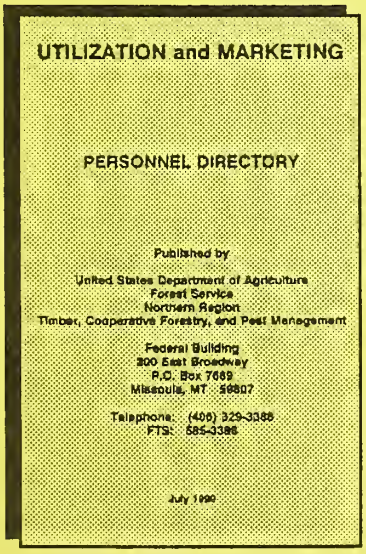
The Forest Products Laboratory has updated its Organizational Directory (October 1990). Included is the FPL organizational chart of the Director's Office, Administration functions, and the Research Work Units.

The Directory includes a mission statement of each Research Work Unit and Special Program along with a listing of research scientists and support staff. Also included is a listing of all Administration function staff.

Limited copies of the directories are available from NWPEP. For a copy, contact:

Theodore A. Peterson
Program Leader
National Wood Products
Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(See p. 8 for phone /FAX numbers and E-mail address)



Vern Meyer, USDA Forest Service, Missoula, MT has updated the Utilization and Marketing Personnel Directory. This should be useful for making professional contacts and developing coordinated, high impact programs.

Included are listings of U & M staff of:

- USDA-Forest Service
- State & Private Forestry
- State Forestry Agencies
- State Foresters
- State Extension Wood Products Specialists
- USDI Bureau of Indian Affairs

Borates For Wood Protection

Borate-based preservatives are a potentially significant addition to the arsenal of treatments that extend the service life of wood used outdoors and above ground. Because of their low toxicity to humans, borates can also be used with structural timbers and indoors and do not require pressure treatment. They are one of the many wood treatment techniques available to help extend the increasingly valuable U.S. timber supply.

Mississippi State University, Oregon State University, and the USDA Forest Service, through its Southern Forest Experiment Station and Southern Region, are cooperating to distribute information about borates. A technology transfer plan called "Borates for Wood Protection" documents their plans for disseminating this knowledge through 1993. A limited number of copies are available from USDA Forest Service, Forest Pest Management, 2500 Shreveport Highway, Pineville, LA 71360.

Much of the knowledge about borates gained through research is ready for application and is already being demonstrated in test houses at two Mississippi locations. Additional test houses are planned for the Virgin Islands and Puerto Rico. Further demonstrations are being considered for other parts of the United States through the National Parks & Recreation Association.

Because of their low toxicity to humans, borates can also be used with structural timbers and indoors . . .

Videotapes on basic borate technology are available from USDA Forest Service, Forest Pest Management, P.O. Box 2680, Asheville, NC 28802. They are currently producing videotapes on treatment of southern yellow pine, and the construction of the test houses. A brochure will accompany the yellow pine and test house tape.

An international conference on treatment of wood with diffusible preservatives is planned for November 28-30, 1990, in Nashville, TN. *(See article below)* About 250 participants are expected. The goal of the conference is to present the benefits and limitations of this technology to the wood-using industry.

(From FPL Techline)

For additional information, contact:

David B. Drummond
Field Office Representative
Forest Pest Management
2500 Shreveport Highway
Pineville, LA 71360
(318)473-7286

William H. Sites
Plant Pathologist
Forest Pest Management
P.O. Box 2680
Asheville, NC 28802
(704)257-4326

Lonnie H. Williams
Project Scientist
Forest Sciences Laboratory
Box 2008 GMF
Gulfport, MS 39503
(601)864-3461

First International Conference on Wood Protection With Diffusible Preservatives

November 28 - 30, 1990
Doubletree Hotel -- Nashville, TN

The purpose of this conference is to provide a forum for: 1) a world-wide review of wood protection with water-diffusible preservatives, and 2) a discussion and compilation of current research and commercial experiences with diffusible preservatives. The conference will begin with overviews by prominent international researchers from countries with a long history of use of diffusible preservatives, continue with a series of specific research efforts and commercial experiences, and close with discussions of research needs for further implementation of diffusible preservative technology. Nearly all aspects of this technology, from the treatment of logs for log homes to treatment of composite panels, will be covered either by oral or poster sessions. In addition to the technical presentations, table-top

Continued on page 7

Textbase available for information retrieval

Exterior Wood Finishing

Finishing Wood Exteriors is one of several textbases to be developed by the National Wood Products Extension Program (NWPEP) to facilitate technology transfer of wood products research through the Cooperative Extension System (CES).

Inquiries on exterior wood finishing average over 1200 per year at the Forest Products Laboratory. Likewise, state and county CES staff are called upon to provide answers and information to thousands of similar questions on wood finishing.

Two publications: Ag Handbook 647 "Finishing Wood Exteriors" and FPL-GTR-60 "Chronicle of 65 Years of Wood Finishing Research at the Forest Products Laboratory" provide updated research-based information.

To help Extension and other professionals quickly access this technical information for query responses, a full textbase has been created for these publications, using commercial software (IZE). Information can be retrieved using keywords or full-text searches. Phone inquiries can be answered directly from the computer screen. Links can also be made to word processing software to download selected textbase information for creating letter responses.

. . . gives you the ability to search, find, organize, read and utilize information . . .

Such textbases would also be useful for preparing Extension program materials, including lesson plans, media releases, and meeting handouts. A low-cost, read-only version of the IZE software provides an effective means for information retrieval in many subject matter fields.

For additional information on how to order and use the Exterior Wood Finishing textbases and the reader version of the software, contact:

F. Robert Mosdal or
Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9412 or E-Mail:
Peterson_T@WISPLAN.UWEX.WISC.EDU

Pressing, *from page 1*

References

Geimer, R.L.; 1982. *Steam injection pressing.* In: Maloney, T.M., ed. Proceedings of the 16th Washington State Univ. International Symposium on Particleboard; 1982 March 30-April 1; Pullman, WA; 1982: 115-134.

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Geimer, R.L.; 1985. *Steam-injection pressing of isocyanate-bonded aspen flakeboards.* Research Paper FPL-456. Madison, WI: U.S.D.A. Forest Service, Forest Products Laboratory. 16 p.

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Harpole, G.B.; Geimer, R.L. 1986. *Economics of accelerated bonding.* Presentation at Cellucon Conference; 1986 April 14-15; Wales. 7 p.

Price, E.W. and Geimer, R.L. 1986. *Thick composites are technically feasible with steam-injection pressing.*Presentation at Composite Board Products for Furniture and Cabinets: Innovations in Manufacture and Utilization. 1986 November 11-13; Greensboro, NC. 18p.

System simulates power turbine operation

Wood-Fueled Combustor-Turbine

Utility and industrial power systems often use gas- or liquid-fueled gas turbine engines. However, the use of coal or wood to directly fuel a gas turbine has not yet become practical, primarily because the ash can adversely affect the turbine blades. If the ash in the combustion gas is molten, the ash may deposit on the blades and corrosion may occur. If the ash is solid particles, it may erode the blades. The size distribution, concentration, and composition of the ash particles will affect the operation of the turbine. Based on work with two prototype combustors, joint studies between the USDA Forest Service's Forest Products Laboratory and the University of Wisconsin have determined that important characteristics of the ash particles can be controlled with a down-draft combustor operating at high excess combustion air.

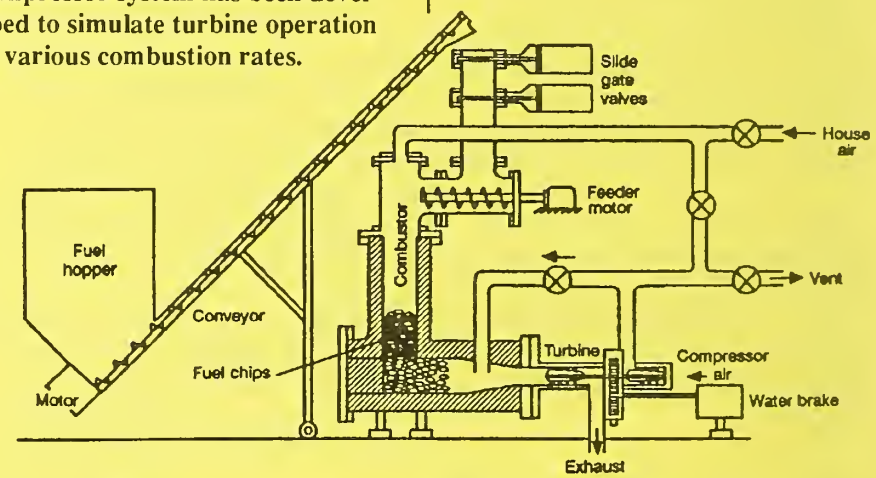
To further test these effects, a unique wood-fueled pressurized down-draft combustor was constructed and tested to determine its operating characteristics, the composition of the combustion gas, and the properties of the ash particulates.

. . . important characteristics of the ash particles can be controlled . . .

Fuel is fed to the combustor through a lock hopper, where it is combusted on a bed of magnesium oxide pellets. It has been operated at a fuel rate of up to 100 pounds per hour with up to 200 percent excess combustion air preheated to 200° C at pressures of 1 to 5 atmospheres. An Allison Model 250 gas turbine engine has been coupled to the combustor and tests are proceeding.

Results to date indicate the combustion rate is sensitive to fuel moisture content, air preheat temperature, and pressure. The combustion gas composition depends on the combustion conditions, and over 80 percent by weight of the particulates are less than 5 microns in size. A model of the combustor-turbine-compressor system has been developed to simulate turbine operation at various combustion rates.

The size, distribution, concentration, and composition of the ash particles will affect the operation of the turbine.



Pressurized downdraft combustor-turbine test setup

The U.S. Department of Energy provides major funding to the University of Wisconsin - Madison for this project. The turbine and technical consulting are provided by the Allison Division of General Motors Corporation, and technical support is provided by the USDA Forest Service's Forest Products Laboratory.

(From FPL Techline)

For additional information, contact:

Andy Baker
Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9472

References

Ragland, K.W.; Aerts, D.J.; Baker, A.J. 1988. *Pressurized downdraft combustion of woodchips.* In: Bridgewater, A.V.; Kuster, J.L., eds. Research in thermochemical biomass conversion: Proceedings, international conference on research in thermochemical biomass conversion; 1988 April; Phoenix, AZ. New York: Elsevier Science Publishing Co.: 744-753.

Ragland, K.W.; Baker, A.J. *Mineral matter in coal and wood - implications for solid fueled gas turbines.* In: Combustion fundamentals and applications: 1987 spring technical meeting of the central states section of the Combustion Institute; 1987 May 11-12; Argonne, IL. Argonne National Lab.: 117-122.

Little is known about wood ash

Mineral Matter of Burned Wood

Minerals are an essential nutrient for tree growth which remain in the wood when the tree is harvested. If the wood is burned, ash particulates are formed from that mineral matter. Little is known about the chemical and physical behavior of mineral matter in wood when it is burned, compared with the extensive investigations on coal and other fuels. Knowledge of the basic processes in the transformation of wood mineral matter to ash can lead to improved designs of boilers and combustors resulting in improved efficiency and durability.

. . . (research) can lead to improved designs of boilers and combustors . . .

The Forest Products Laboratory (FPL) and the University of Wisconsin-Madison are studying the effects of temperature and residence time on mineral matter volatile release and particulate matter formation. The volatilization and condensation of potassium, calcium, phosphorus, sodium, silica, and other mineral substances in wood and bark are being studied in a tube furnace using scanning electron microscopy (SEM), electron spectroscopy, and differential thermal analysis of wood ash. The formation of particulate matter nodules on the surface of wood and bark char will be studied in situ using fiber optics and SEM.

This study should develop basic information about how wood ash particles form, their chemical nature, and how chemical composition affects the temperatures at which ash becomes molten and volatile.

The National Science Foundation is providing major funding for this project with financial and technical support from the FPL.

(From FPL Techline)

For more information, contact:

Andy Baker
Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9472

Mineral Matter in Whole Aspen Tree
(without leaves)

Elements	Percent of tree weight	Elements	Percent of tree weight x 10^{-6}
Total ash, as oxides	1.45	Iron	53.5
		Zinc	43.9
Calcium	0.416	Manganese	21.7
Potassium	0.131	Aluminum	11.4
Magnesium	0.050	Sodium	11.1
Phosphorus	0.036	Copper	9.8
Sulfur	0.0104	Boron	6.2
		Lead	1.8
		Cadmium	0.4

Reference

Ragland, K.W.; Baker, A.J. 1987. *Mineral matter in coal and wood - Implications for solid fueled gas turbines.* In: Combustion fundamentals and applications: 1987 spring technical meeting of the central states section of the Combustion Institute; 1987 May 11-12; Argonne, IL: Argonne National Laboratory: 117-122.

Conference, *from page 4*

displays will feature products and services of various suppliers of diffusible chemicals and treating equipment.

This conference will be of direct benefit to a wide range of industries that may profit from using diffusible preservative technologies to produce value-added products with protection from fungi and insects. These industries include manufacturers of: hardwood and softwood lumber; modular and factory built housing, roof trusses, furniture, flooring, shakes and shingles, and other building components; log homes; outdoor furniture and recreational structures; pallets and containers; crossties; utility poles, posts, and pilings; composite panels; and many other products. The conference will also serve as a useful forum for suppliers of treating chemicals and equipment and wood treatment industry personnel.

For further information or to register, contact the Forest Products Research Society, 2801 Marshall Ct., Madison, WI 53705
phone: (608)231-1361
FAX: (608)231-2152.

From The Program Leader -

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program stands ready to assist you.

The National Wood Products ExtensionProgram (NWPEP) is currently funded as a 3-year special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. In this way, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

This issue highlights research information on the use of wood-based fuels. The current Mideast crisis underscores the growing importance of alternative energy sources. Indeed, the recent directive of Secretary Yeutter to use gasolines containing ethanol in government highway vehicles signals a serious proposal for improving air quality and reducing dependence on foreign oil. Technology transfer of energy information through newsletters and research reports is an urgent need.

Extend is produced in-house using the publishing tools available to users of IBM PCs and compatibles. Camera-ready copy of *Extend* was produced on an IBM-AT (386) PC, using a Viking I Moniterm full-page monitor for page composition. The issue was proofed on an Apple Laserwriter Plus Postscript printer. Manuscripts were entered using Microsoft Word For Windows. Pages were composed in PageMaker 3.01.

Some graphics were created in Corel Headlines and CorelDraw and imported as EPS files. Images were scanned with a Kurzweil 5100 scanner and imported as TIFF files. The fonts used are Postscript versions of TimesRoman and Helvetica from Adobe Systems.

The entire PageMaker file can be 'printed to disk' as a Postscript file, significantly compressed, and transferred as an ASCII file via E-MAIL - complete with text and graphics as you see in this printed edition. This opens up tremendous opportunities for information distribution on the proposed CES Communications network using NSFNET and Internet.

Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330; FTS 384-5330; FAX (608)231-9592; EMAIL Peterson_T@WISPLAN.UWEX.WISC.EDU

Directive to use oxygenated Fuels

Oxygenated Fuels In USDA Highway Vehicles

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

September 13, 1990

SECRETARY'S MEMORANDUM 5400-2

Use of Ethanol-Blended Oxygenated Fuels in USDA Highway Vehicles

President Bush has proposed two initiatives to reduce American dependence on foreign oil and enhance environmental quality. The initiatives are the National Energy Strategy and the Clean Air proposal. Both initiatives rely heavily on the use of alternative fuels. Use of ethanol-blended oxygenated fuels will be an important means toward reaching these goals.

President Bush's clean air proposal relies heavily on oxygenated fuel to help improve our air quality. Gasoline contains no oxygen and when burned in most automobiles results in incomplete combustion. Adding oxygen to gasolines improves combustion and reduces carbon monoxide levels of automotive emissions by 15 to 35 percent depending on the make and model of the vehicle. Oxygenated fuels can materially reduce hydrocarbons and other noxious emissions which react in sunlight and form ozone or smog.

Gasolines can be oxygenated with ethanol and ETBE (ethyl tertiary butyl ether) produced from corn and other agricultural products. Use of these fuels enhances environmental quality, reduces the volume of petroleum imports required, increases the demand for grain, and reduces the cost of farm commodity programs. Oxygenated fuels made with ethanol are good for agriculture and good for America.

Therefore, effective immediately, it is the policy of the United States Department of Agriculture that its employees purchase and use fuels containing ethanol or ETBE in USDA-owned or leased highway vehicles when such fuels are available at comparable prices with regular unleaded gasoline. Use of ethanol-blended gasoline has been approved by all automobile manufacturers.

I encourage all employees to weigh the benefits of using alternative fuels. As our farmers are good stewards of our natural resources -- land, water, and air -- so also shall USDA employees be good stewards by using gasolines blended with ethanol and ETBE made from domestically grown renewable resources.

Clayton Yeutter
Secretary

DISTRIBUTION: 50

OPI: OE

Yeasts identified to ferment xylose to ethanol

Ethanol Production From Xylose

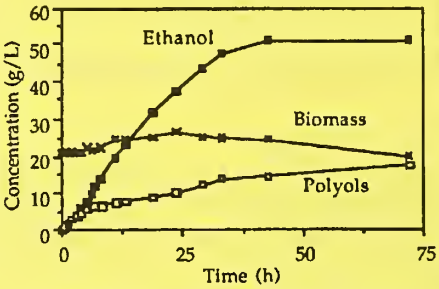
Using the xylose produced when wood is hydrolyzed has long been a technical barrier to fermenting other sugars produced in the same process. Xylose is an abundant sugar in hardwood hemicellulose, and it is readily recovered through acid or enzymatic treatment. The yield of xylose from the hemicellulose of red oak is almost equal to the yield of glucose. Unlike glucose, however, xylose is not fermented by *Saccharomyces cervisiae* or other common yeasts.

Researchers at the Forest Products Laboratory have found that a few yeasts, most notably *Pachysolen tannophilus, Candida shehatae, and Pichia stipitis,* can ferment xylose to ethanol at yields of up to 0.44 g ethanol /g xylose and at concentrations of as much as 56 g/liter.

The addition of glucose to xylose fermentations can increase ethanol yields and concentrations. Maximal ethanol fermentation rates and yields are obtained in fed-batch fermentations.

Both ethanol and xylitol are produced. Ethanol is used in pharmaceuticals and as an octane-enhancer in unleaded fuel. Xylitol is a non-sugar sweetener that does not promote tooth decay and has excellent confectionary properties.

Toxic lignin degradation products can create special problems when fermenting some acid hydrolysates. However, dilute acid hydrolysates



Candida shehatae will convert xylose to ethanol at recoverable concentrations in a fed-batch fermentation.

from sulfite pulps can be treated to render them fermentable.

FPL researchers have produced improved strains of *P. tannophilus* and *P. stipitis* through mutagenesis and strain selection. Biochemical and physiological studies indicate that the induction of alcohol dehydrogenase is critical to a successful fermentation.

For additional information, contact:

Thomas W. Jeffries
Supervisory Microbiologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9453

(From FPL Techline)

References

Harris, J.F.; Baker, A.J.; Connor, A.H.; Jeffries, T.W., et al. 1985. *Two-stage, dilute sulfuric acid hydrolysis of wood.* Gen. Tech. Rep. GTR-FPL-45. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory.

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Jeffries, T.W.; Sreenath, H.K. 1988. *Fermentation of hemicellulosic sugars and sugar mixtures by Candida shehatae. Biotechnol. Bioengineer. 31:502-506.*

LUMBER DEFECTS

Furniture manufacturers usually require lumber that is free of damage by insects, fungi, and chemical stains. Defects caused by these agents can affect the appearance and strength of wood.

Wood from sound logs that is properly processed and stored may remain free of damage indefinitely. When wood is dry, fungi and chemical stains become inactive. To prevent or control monetary and quality losses from these causes, you must be able to differentiate the types of damage.

AG-425 *Lumber Defects Caused by Insects, Fungi, and Chemical Stains* is an excellent, illustrated guide that will be useful to those involved in furniture manufacturing. This publication was supported in part with Renewable Resources Extension Act funds.

Copies of AG-425 may be obtained for $5.00 each from:

Agricultural Communications
Campus Box 7603
North Carolina State University
Raleigh, NC 27695-7603

(Payment must accompany order.)

Chemicals for fuel use can be produced from wood

Alcohol Production

Both ethanol and methanol (types of alcohol suitable for fuel use) can be produced from wood. Yet only about 4 to 5 million gallons of alcohol are produced from wood each year in the United States, compared with almost 1 billion gallons of fuel alcohol produced from grains.

Current commercial biomass alcohol processes derive ethanol mainly from corn. Much of it is also produced synthetically from petroleum. Methanol is produced principally from natural gas, with a small contribution from coal. Wood-derived alcohol is produced from the waste liquor of a pulping operation.

Technology for ethanol production has been developed . . .

Technology for ethanol production from wood has been developed and subjected to some pilot testing. The economic competitiveness of producing ethanol from wood depends on feedstock costs and other variables. Production and marketing of byproducts (high-fructose corn syrup and distiller's dry grains from corn and molasses and furfural from wood) significantly affect this economic balance. Ethanol production from wood could be implemented fairly rapidly, should another global petroleum emergency create the need for alternative fuels. However, some additional pilot testing of the technology may be needed.

Wood-derived alcohol is produced from the waste liquor of a pulping operation.

The Forest Products Laboratory and the Tennessee Valley Authority's National Fertilizer Development Center have developed and pilot tested a process for producing ethanol from low-grade hardwoods. Called the two-stage, dilute sulfuric acid hydrolysis process, it converts wood to carbohydrates that can be fermented into alcohol. The second stage of two-stage hydrolysis produces about 20 kg of carbohydrates suitable for processing to ethanol from every 100 kg of ovendry wood feedstock. The first stage produces an additional 24.9 kg of carbohydrates, but many of these first-stage carbohydrates are not necessarily fermentable to ethanol.

If xylose could be fermented to ethanol economically, fermentation of the first-stage products, xylose and glucose, could nearly double ethanol production, compared with only fermenting the glucose from the second stage. Other possible products from the first-stage carbohydrates are single-cell protein, furfural, and feed molasses.

The technology for producing methanol from wood is less fully developed than that for producing ethanol. Although methanol was once produced from wood as a byproduct of charcoal manufacturer, overall yields were low. To produce methanol from wood with a significantly higher yield would require production of synthesis gas in a process similar to that used for production of methanol from coal.

For additional information, contact:

John Zerbe
Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(From FPL Techline)

Reference

Harris, John F., et al. 1985 *Two-stage, dilute sulfuric acid hydrolysis of wood: an investigation of fundamentals.* Gen. Tech. FPL-45. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 73 p.

CONFERENCE

New Developments in Primary Processing

Rutland, VT
November 7 -- 8, 1990

Recent developments in automation and computer control of lumber manufacturing processes.

For further information, contact: Dan Bousquet, Forest Products Extension Specialist, 343 Aiken Center for Natural Resources, Univ. of VT., Burlington, VT 05405 Phone: (802)656-3258

National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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Feedback !

We hope *Extend* is serving your programming needs. Please share this information with your colleagues and clients.

Your feedback is appreciated -- and needed! Please let us know how we are doing. The National Wood Products Extension Program stands ready to serve you better -- but two-way communications is required. Thanks for taking time to give us your valued comments.

-- NWPEP Program Leader

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 5 May 1991

An answer to the U.S. landfill crisis

Wastepaper Recycling in the 1990's

More than 26 million tons of paper consumed in the U.S. were recovered for domestic recycling or export in 1989; more than 20 million tons were recycled in U.S. paper and paperboard mills. However, more than 50 million tons per year of wastepaper must still be landfilled or incinerated.

In This Issue:

Many municipalities have responded by enacting laws that require citizens to sort and separate their trash, including wastepaper materials, for recycling. Supplies of recyclable wastepaper have therefore been increasing, as reflected by sustained low prices for certain wastepaper commodities, such as old newspapers.

The recovery of wastepaper for domestic recycling and export will undoubtedly increase substantially in the 1990's. In a major public commitment to recycling, the U.S. paper industry announced its national goal of 40 percent wastepaper recovery for recycling by 1995 (from the 32.6 percent recovery rate in 1989).

The ultimate measure of wastepaper recycling success will be judged by the actual utilization rate of wastepaper in U.S. paper and board mills in relation to paper and board production. In 1989, the wastepaper utilization rate was 26.4 percent. According to FPL projections, if the industry wastepaper recovery goal is achieved by 1995, the utilization rate will be around 31% by the year 2000.

Continued on page 3

A 1989 report of the Congressional Office of Technology Assessment underscored the U.S. landfill crisis:

. . . we generate over 160 million tons of municipal solid waste each year — more than one-half ton per person — and the amount is rising steadily . . . In 1986, only about 10 percent was recycled and 10 to 15 percent was incinerated . . . while almost 80 percent was disposed of in landfills . . . The Environmental Protection Agency estimates that 80 percent of existing permitted landfills will close within 20 years.

COOPERATIVE EXTENSION SERVICE
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USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

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SYSTEM

Lumber Manufacturing Program

BOF

Sawing Simulation Analysis Routine

Why Use BOF?

BOF Sawing Simulation Analysis can be used to assess the current level of lumber conversion efficiency and to improve management control in dimension sawmills. It has wide use in planning models, analyzing marketing and product mix decisions, and analyzing many types of lumber manufacturing operations.

Corporate simulation models, with sawmill simulation models as a component, are being used for both long- and short-range planning. In short-range planning, the sawing simulation model can be used to allocate the distribution of logs among alternative processing centers. In long-range planning, the model can be used to assess the effects of change before they happen. Many more alternatives can be assessed than would otherwise be possible. Plants can be theoretically built, operated, moved, or removed to find the most profitable facility.

Marketing and product mix decisions can also be improved through the use of computer simulation. The effects of changes in product prices or product demand on mill productivity can be evaluated.

Sawing simulation models can be used to aid in making decisions that directly affect mill operations, thus reducing the possibility of making a costly physical change that may have adverse effects. The effect of operating changes, such as changing sawkerf or target sizes, can be evaluated without having to actually implement the change in the mill proper. The simulation model can show the effect of poor operator decisions on the profitability of an operation.

. . . designed for use by mill owners and operators to assess the current level of lumber conversion efficiency.

Sawing simulation models can predict maximum lumber recovery. This information can help pinpoint reasons for not achieving that recovery. Also, it can provide justification for necessary changes.

Sawing simulation models can be used to aid in the design of new sawmill layouts. Performance specifications can also be determined.

Finally, sawing simulation models can be used as a component of automated control systems. While primarily designed for control of primary breakdown, they are often used at edging, trimming, and log bucking machine centers.

Description of Routine

The computer program disk for BOF Sawing Simulation Analysis includes a set of compiled Pascal and Fortran programs designed to work together. This routine uses the Best Opening Face (BOF) model which was developed by researchers at the U.S. Forest Products Laboratory.

BOF Sawing Simulation Analysis can handle two distinct types of log information - a distribution of logs or a set of actual logs. Log distribution data are handled by BOF Sawing Simulation Analysis directly. The program prompts for the range of log lengths and diameters and the taper for all logs in the distribution. Actual log data, however, must be initially entered into the Log Analysis routine before BOF Sawing Simulation Analysis can handle them (See article on Log Analysis in *Extend*, August 1990). The BOF Sawing

Continued on page 3

BOF, *from page 2*

Simulation Analysis routine will read the data files written by the Log Analysis routine. The procedure for entering actual log data is described in the Log Analysis User's Manual.

BOF Sawing Simulation Analysis can be used to model various mill setups by changing the input variables and rerunning the BOF model. However, because the routine uses standard file names, you must be careful to avoid overwriting data you wish to save while making reruns.

Output includes the following:

Individual Log Solutions
- Diameter, Length, and Taper
- Position of the Opening Faces (Log/Cant)
- Nominal Cant Size (if cant sawing)
- Lumber Recovery Factor (LRF)
- Lumber Tally

Summary Tables
- Total Number of Pieces
- Total Board Foot Tally
- Total Board Foot Tally (expressed as a percentage)

For additional information and for requests of the compiled software program, contact:

State & Private Forestry
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9327

Reference

Lewis, D.W. 1985. *Sawmill Simulation and the Best Opening Face System . . . A User's Guide.* Gen. Tech. Rpt. FPL–48. Madison, WI:USDA Forest Service, Forest Products Laboratory.

Scaling up for commercial operations

Wastepaper Contaminant Removal

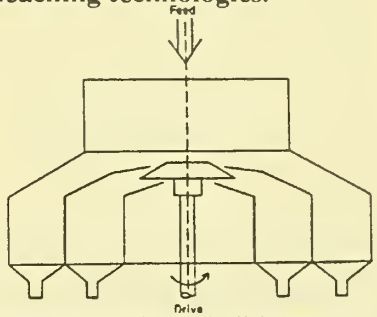
Wastepaper recycling technology is stymied by technical barriers to producing clean pulps derived from wastepapers. Overcoming the barriers that relate to deinking and synthetic adhesive contaminant removal is critical to economically increasing the rate of wastepaper recycling in the U.S. Moreover, advances in separation science and technology are critical to the future of U.S. economic competitiveness in many areas.

The Forest Products Laboratory (FPL) is developing a program for improving wastepaper recycling contaminant removal and deinking processes as well as developing advanced disk separation concepts. The FPL has previously conducted research on deinking, fiber recovery from household trash, and process and product development.

Increasing the throughput from 0.25 to 3 - 5 metric tons (ovendry) per day remains an objective of FPL research.

Currently, the FPL is developing a program that delineates research needed for increasing wastepaper recovery from municipal solid waste. This program is designed to help achieve the 40-percent wastepaper recovery target set by the U.S. paper industry for 1995 and to develop new recycling technology and new uses for wastepaper and wood wastes.

Research that is critical for carrying out this program will address (a) new fiber cleaning methods, (b) new concepts for fiber bonding, (c) fundamental structural and chemical changes in wood, (d) economic cost-benefits of recycling projects and processes, (e) new fiber-sorting technologies, and (f) new pulp-bleaching technologies.



Schematic of pilot-scale disk separator

The FPL research on new fiber cleaning methods includes research on disk separation. This research has demonstrated the possibility of separating fibers based on differences in wetting properties as well as size and density. In the disk separation process, a pulp slurry is fed to the center of a cone on top of a smooth, wide-lip disk that spins at a high speed; particles are separated according to size, density and wettability. Large, dense, and hydrophobic particles are rejected at the disk shoulder. At present, disk separation needs to be scaled-up to production processing rates. However, scaling-up to the processing rate by merely enlarging the disk dimensions has resulted in reduced separation efficiency.

Recent research results help scientists to better understand the mechanisms involved with disk separation. High speed photographs of a hydraulic split at the disk shoulder during disk separation suggest that contaminants are removed by particle migration in a high shear field on the disk face before the pulp slurry reaches the disk shoulder in the initial stage of separation.

Continued on page 4

Recycling, *from page 1*

A recent FPL study was conducted to present information on likely rates of wastepaper recycling by product grade in the late 1990's and to project the anticipated market consequences in terms of regional timber consumption and prices.

. . . recycling will result in a smaller projected increase in future pulpwood harvest.

It was concluded that accelerated recycling will result in a smaller projected increase in future pulpwood harvest. This in turn will result in a substantial reduction of projected future price increases for pulpwood and softwood sawtimber stumpage. Increased stumpage prices associated with preservation of habitat for some endangered species, such as the northern spotted owl, will tend to be offset in the long run. However, this offset may not avoid near-term impacts on timber supply, prices, and employment in the Pacific Northwest.

With accelerated wastepaper recycling, prices for delivered Southern softwood and hardwood pulpwood will approach equivalency by around 2000. Accelerated wastepaper recycling will offset future demand growth for softwood pulpwood more than for hardwood, and it will mainly offset demand growth in the South.

(Excerpt from paper presented at SAF National Convention, Washington, DC, July 29-August 1, 1990)

For additional information, contact:

Peter J. Ince, Research Forester
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9364

Contaminant, *from page 3*

This postulated mechanism needs to be confirmed by further research. A better understanding of the interaction of particles with hydraulic shear should result in geometry changes in disk separation that will permit scale-up of separation rates without loss in separation efficiency.

Disk separation is of commercial interest. If such a separation could be scaled up, fiber recovery from papermill tailing streams could be recovered economically. Increasing the throughput from 0.25 to 3 - 5 metric tons (ovendry) per day remains an objective of FPL research.

For additional information, contact:

John H. Klungness,
Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9437

References

Klungness, J.H. 1987. *Disk Separation: Fiber Recovery from Recycled Newsprint Papermill Tailings.* In Pulping Conference Proc., TAPPI Press, Atlanta, 11:729.

Klungness, J.H. 1987. *Disk Separation: Optimization of Contaminant Removal.* Tappi Jour. 70(3):131.

Klungness, J.H., Cheng-Hsiug Lin, Rowlands, R.E. 1990. *Contaminant Removal From Recycled Wastepaper Pulps.* In Pulping Conference Proc., TAPPI Press, Atlanta, Book 1:8-12.

Klungness, J.H., and Evans, J.W. 1989. *Increased Disk Separator Throughput.* In TAPPI Notes, Contaminant Problems and Strategies in Wastepaper Recycling Seminar, TAPPI Press, Atlanta, 121.

of the Office of Solid Waste

In its public outreach effort, the Office of Solid Waste maintains several mailing lists. If interested, indicate the mailing list(s) to which you would like to have your name added:

_____ Solid Waste (includes Recycling and Reusable News*
_____ Recycling Used Oil
_____ Medical Waste

(* if you receive *Reusable News*, you are already on the Solid Waste list)

Return a copy of this notice with your name and address to:

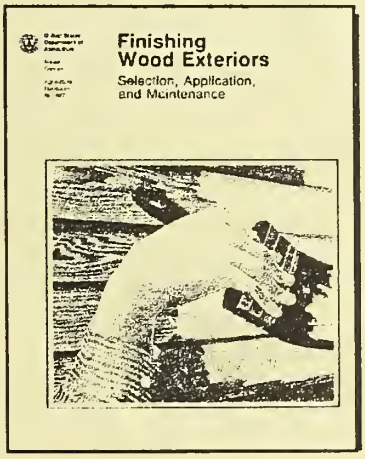
RCRA Docket Information Center
Office of Solid Waste (OS-305)
Washington, DC 20460

Textbase available for information retrieval

Exterior Wood Finishing

Information professionals and users are challenged to search through thousands of new and old texts for data to keep updated and to provide information that people need and request.

Microcomputers can facilitate information management and access. The National Wood Products Extension Program (NWPEP) has prepared a comprehensive textbase on the subject of exterior wood finishing (*Finishes*), using one of the available commercial retrieval software packages (*IZE*). This is one of several textbases under development by NWPEP.



Recent major research publications are included: Ag Handbook 647 *Finishing Wood Exteriors: Selection, Application and Maintenance* and FPL-GTR-60 *Chronicle of 65 Years of Wood Finishing Research at the Forest Products Laboratory.* Also included are textbook chapters on wood finishing and two publications on the finishing and maintenance of wood floors: Oak Flooring Institute, Affiliate of National Oak Flooring Manufacturers Association (NOFMA) *Hardwood Flooring Finishing/refinishing Manual* and North Central Regional Extension Publ. 136 *Wood Finishing — Finishing and Maintaining Wood Floors.*

Accessing Information

Extension professionals, point-of-sales staff, and other information providers can quickly and easily access this unique textbase on a PC-microcomputer. Full text on a wood finishing subject can be retrieved using keyword, Boolean, or global searches.

Using Information

Not only can you retrieve and view the textbase information on the computer screen, but selected text can be printed, exported to an ASCII file, or reorganized for other uses.

Full text . . . can be retrieved using keyword, Boolean, or global searches.

For example, a phone inquiry about mildew control on a painted surface can be quickly answered following a rapid keyword search of the textbase by keying in 'mildew'. Information on the screen describes what mildew is and how it can be controlled — including the recipe for a wash solution.

A similar mail inquiry can be easily handled following the textbase search by exporting selected text to a response letter being composed in the PC word processor.

Availability

'*Finishes*' Textbase

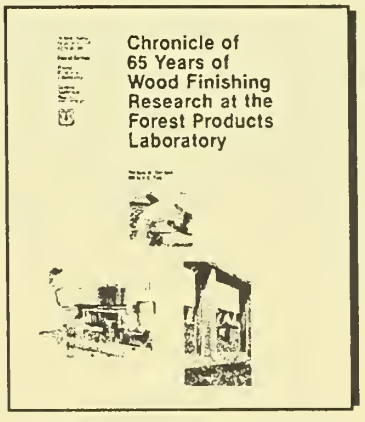
The exterior wood finishing textbase (*Finishes*) is available from the National Wood Products Extension Program at no cost. The software runs on IBM-compatible microcomputers with a hard disk drive. Please send two formatted 5 1/4 in. (360K) or one 3 1/2 in. (720K) double-sided/double-density disks with your request.

Commercial Software

The commercial software (*IZE*) required to access the textbase is available with an educational discount for educators in two versions from:

Retrieval Dynamics, Inc.
465 Science Drive
Madison, WI 53711
(608)273-6000

IZE (ver. 2.0) is the standard package which allows you to develop and edit other textbases for searching and retrieving information $195.00



IZE Reader is the read-only package which provides search and retrieval capability, but not the textbase development and editing capability $69.00

For more information, contact:

F. Robert Mosdal or
Theodore A. Peterson

National Wood Products
Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330 or E-Mail:

Peterson_T@WISPLAN.UWEX.WISC.EDU

Waterborne preservatives can reduce wood strength

Strength Losses of Redried Treated Wood

Waterborne preservative treatment of wood produces a clean, odor-free, paintable/stainable product. Yet, waterborne preservatives can reduce wood strength. The extent of this effect depends on several key factors, such as preservative chemical, redrying temperature, species/grade/size, and incising. Researchers at the Forest Products Laboratory are studying how each of these factors affect lumber properties.

The relative impact of a waterborne preservative relates directly to its chemistry and the severity of its fixation/precipitation reaction. Studies have shown that ammoniacal copper arsenate (ACA) and ammoniacal copper zinc arsenate (ACA) affect strength less than chromated copper arsenate (CCA). The impact of various CCA formulations appears to be related to chromium content.

The higher the redrying temperature, the greater the negative effect on mechanical properties.

All terrestrial retention levels appear to have similar effects on strength when redried at comparable temperatures. However, the higher retentions required for marine use (2.50 lb/ft^3) do significantly reduce bending and impact strength and reduce compression strength when redried at 140°F.

Redrying temperature appears to be the most decisive single processing factor affecting strength. The higher the redrying temperature, the greater is the negative effect on mechanical properties. Air drying after treatment appears to have little practical effect on strength.

The impact of various CCA formulations appears to be related to chromium content.

It appears that no differential species effect exists. Generally, higher grades are reduced in strength more than lower grades; smaller sizes more than larger sizes.

Incising is used with difficult-to-treat species to improve preservative penetration and distribution. Incising reduces strength. However, this strength loss is more than offset by the improved performance of the incised treated product. The technical literature supports a 10 to 20 percent reduction in allowable design stresses for 2-inch-thick lumber and a 0 to 10 percent reducton for thicker material.

(From FPL Techline)

For more information, contact:

Jerrold E. Winandy, Research Wood Scientist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9262

References

Bendtsen, B.A.; Gjovik, L.R.; Verrill, S. 1983. The mechanical properties of salt-treated longleaf pine. Res. Pap. FPL-RP-434. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.

Soltis, L.A.; Winandy, J.E. 1989. Long-term strength of CCA-treated lumber. Forest Products Journal 39(5):64-68.

Winandy, J.E. 1989. CCA preservative treatment and redrying effects on the bending properties of 2 x 4 southern pine. Forest Products Journal 39(9):14-21.

Winandy, J.E.; Boone, R.S. 1988. The effects of CCA preservative treatment and redrying on the bending properties of 2 x 6 southern pine lumber. Wood and Fiber Science 20(3):350-364.

Winandy, J.E.; Boone, R.S.; Bendtsen, B.A. 1985. The interaction of CCA preservative treatment and redrying: effects on the mechanical properties of southern pine. Forest Products Journal 35(10):62-68.

Winandy, J.E.; Boone, R.S.; Gjovik, L.R.; Plantinga, P.L. 1989. ACA and CCA preservative treatment and redrying effects on bending properties of Douglas-fir. Proceedings AWPA, Vol. 85, p. 106-118.

A videocourse for individual study

Inspection, Maintenance and Repair of Wood Structures

Wood has long been used as a building material. There are examples of structures that have lasted hundreds of years. Why then do some succumb to rot in only a few years? Is it possible to prevent rot? If rot has started, can the structure be repaired? What are the allowable bending stresses for wood members?

You get answers to these questions as well as questions you may have concerning structural evaluation of trusses, repair of Glu-lam beams and arches, how to evaluate fire damage and much more.

This course includes a series of six videotapes, a study guide, and two reference books. The videotapes were made during a presentation to a live audience and then edited for individual study. The speakers (several are scientists from FPL) use visual tables, charts and pictures to illustrate their presentations. Each tape addresses a separate topic. The course was targeted to update and educate practicing engineers, architects and technicians. Educators, including Extension housing specialists and ag engineers, will find the course useful for self-improvement and for programming.

. . . educators will find the course useful for self-improvement and for programming . . .

Videotape Highlights

- Condition evaluation standards for timber structures (Gerald E. Sherwood)
- Non-structural wood elements (R.Sam Williams)
- Biological deterioration inspection and prevention (Joe W. Clark)
- Structural evaluation (Keith F. Faherty)
- Methods of repair (Robert M. Powell and Robert W. Emmerich)

An 18-minute preview tape is available so you can see how this videocourse will benefit you before you purchase. You can obtain the preview tape postpaid for $15. The cost for the complete course is $550.

For a course brochure and further information , call the toll free number 800-462-0876 of the UW-Madison, Dept. of Engineering. Ask for Engineering Information and Rolf Killingstad or Janice Friis.

memo

New FPL Deputy Director

Ken Peterson, of Atlanta, GA, joined the USDA-FS, Forest Products Laboratory (FPL) as Deputy Director, in March.

Peterson will assist Director John Erickson in overseeing FPL's diverse research programs in wood processing and protection, wood products, wood chemistry and paper, biotechnology, international forest products, and energy from wood.

Peterson was previously Director of Technical Services for Wood Products for the Georgia-Pacific Corporation. Before joining Georgia-Pacific in 1974, he was a professor of wood science and technology at the University of Illinois for 11 years and the technical director of the American Hardboard Association for eight years.

He is a member of the National Forest Products Association, the American Plywood Association, the American Wood Preservers' Association, the National Fire Protection Association, the Southern Forest Products Association, the Southern Pine Inspection Bureau, and the Hardwood Research Council. He also serves on a number of wood-related committees in these organizations. He served as president of the Forest Products Research Society in 1988 and on the executive board of the Society of Wood Science and Technology.

Peterson completed his undergraduate work in forest management at the University of Massachusetts and his graduate work in wood technology and utilization at Yale University.

Peterson succeeds Hank Montrey, who became the director of the Rocky Mountain Forest and Range Experiment Station in Fort Collins, Colorado.

(From FPL Press Release)

From The Program Leader -

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program stands ready to assist you.

The National Wood Products ExtensionProgram (NWPEP) is currently funded as a 3-year special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison. This is the last year of the special project funding.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. In this way, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

This issue highlights research information on RECYCLING wood-based products. Growing, major domestic/global waste disposal crises clamor for resolution. Research efforts leading to both improved products and alternative uses of our recyclable waste streams are essential. Similarly, access to and adoption of such research information are equally important if recycling problems are to be resolved. The Cooperative Extension Service can be a vital collaborator in these technology transfer efforts.

Extend is produced in-house using the publishing tools available to users of IBM PCs and compatibles. Camera-ready copy of *Extend* was produced on an IBM-AT (386) PC, using a Viking I Moniterm full-page monitor for page composition. The issue was proofed on an Apple Laserwriter Plus Postscript printer. Manuscripts were entered using Microsoft Word For Windows. Pages were composed in PageMaker 4.0.

Some graphics were created in Corel Headlines and CorelDraw and imported as EPS files. Images were scanned with a Kurzweil 5100 scanner and imported as TIFF files. The fonts used are Postscript versions of TimesRoman and Helvetica from Adobe Systems.

The entire PageMaker file can be 'printed to disk' as a Postscript file, significantly compressed(up to 90%), and transferred as an ASCII file via E-MAIL - complete with text and graphics as you see in this printed edition. This opens up other tremendous opportunities for information distribution - beyond generic text - on the proposed CES Communications network using NSFNET and Internet.

Theodore A. Peterson
National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330; FTS 384-5330; FAX (608)231-9592; EMAIL Peterson_T@WISPLAN.UWEX.WISC.EDU

Using waste wood in concrete

Chunkrete

The waste wood that ends up in the Nation's landfills could be reduced to small chunks and used to replace the gravel in concrete to provide a lighter weight concrete that would still be strong enough for many uses.

An experimental mixture of cement, sand, and wood chunks less than 3 inches in size is being developed by the Houghton, Michigan, laboratory of the Forest Service's North Central Forest Experiment Station.

. . . chunkwood is used to replace gravel or stone aggregate.

"Chunkrete," named by research mechanical engineer Rodger Arola, becomes lighter but less strong the more chunkwood is used to replace gravel or stone aggregate. It is similar to other types of lightweight concrete already developed. So far chunkrete beams and cylinders that are half chunkwood half gravel, and others that are all chunkwood, have been tested and compared with standard concrete.

Chunkrete with all gravel replaced by chunkwood is about one-third as strong in compression tests and one-half as strong in bending tests as standard concrete, and is about 25 percent lighter. It can withstand up to 1250 pounds per square inch compression, has a bending strength of up to 450 pounds per square inch, and weighs less than 120 pounds per cubic foot. It would be suitable for many uses such as temporary traffic barriers, bases for traffic signs, cement pads for trailer parking, and sidewalks. Chunkrete might also be useful where gravel for concrete is scarce but wood is plentiful, as in some developing countries.

The waste wood going into landfills has been estimated by the Forest Products Laboratory to be almost 6 million tons a year, or roughly equal to one-fifth the annual cut on the Nation's National Forests. "Instead of being burned and releasing carbon dioxide to the atmosphere or going into landfills, waste wood from demolished housing, old pallets, and municipal tree cuttings could be recycled and used in chunkrete," Arola said. The Houghton laboratory has already developed a machine that cuts chunks from trees, branches, and waste wood.

Future research should concentrate on mix proportions, how mix and curing time affect strength, and the behavior of chunkrete during freezing and thawing. "We believe there are a lot of opportunities to develop cooperative research with universities, the Forest Products Laboratory, and industry," Arola said.

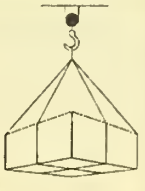
(from NCFES news release)

For more information, contact:

Rodger Arola
Research Mechanical Engineer
USDA-FS-NCFES
Forestry Sciences Laboratory
Forest Hill Road
Houghton, MI 49931
(906)482-6303

Developing a successful strategy

Exporting



This handbook provides a guide for U.S. wood products producers to develop a successful export marketing strategy. It covers how to obtain accurate and up-to-date export marketing information so that production, scheduling, and shipping of U.S. wood products can be done profitably.

This is the first revision of the handbook originally published in 1986. Portions of the revised publication draw on work done by the USDA's Office of Transportation and its publication, *Export Handbook for U.S. Agricultural Products.*

Further information on Ag Handbook No. 662 *(Rev.) A Guide to Exporting Solid Wood Products* can be obtained from USDA, Foreign Agricultural Service, Forest Products Division, Washington, D.C., (202)382-8138.

Efficient storage and access of research information

Developing an FPL CD-ROM Disc

The importance of *wood* as a unique, renewable, energy-efficient raw material continues to increase in the U.S. and abroad. Significant opportunities exist to improve the growing, harvesting and marketing of timber, the productivity and competitiveness of woodusing industries in rural America and the use of wood by consumers.

For more than 80 years the U.S. Forest Products Laboratory (FPL) has been a world leader in all aspects of fundamental wood products research. FPL has helped extend the world's supply of wood through more efficient raw material use, through increased product longevity, and through creative product development. Wood products research information from FPL and other agencies and universities is avail-

. . . the FPL has been a world leader in . . . wood products research.

able and needed to help revitalize America. Indeed, information management (processing, accessing, and distribution) is a vital key to rural economic development. The question is, are we utilizing the wealth of information generated in our research laboratories, such as FPL?

NWPEP

The National Wood Products Extension Program (NWPEP), located at the FPL, facilitates the transfer of wood products technology developed at the FPL and elsewhere, through the nationwide(federal, state and county-based) Cooperative Extension System. In this way, Extension is strongly linked with important national wood products technology transfer efforts of the Forest Service, other federal and state agencies, and industry.

. . . CD-ROM provides fast, efficient information access and retrieval . . .

A key activity underway is the in-house development of a custom CD-ROM disc of FPL research-based wood information. This new technology promises cost-effective, efficient information managment for the future.

What's CD-ROM?

CD-ROM technology offers an effective means for storing and accessing research information. CD-ROM disc players are available at reasonable, decreasing cost for the large microcomputer user base.

A fast, efficient information search and retrieval capability is now available on a huge compact disc database for researchers, Extension professionals, business, and other clientele.

Each 4 1/2 in. disc can store about 650 megabytes of information — text, graphics, and audio. For example, the entire set of 26 volumes of the Compton's Encyclopedia (Britannica Software) is on one disc, including full-text, audio, and full-color graphics!

Information Processing

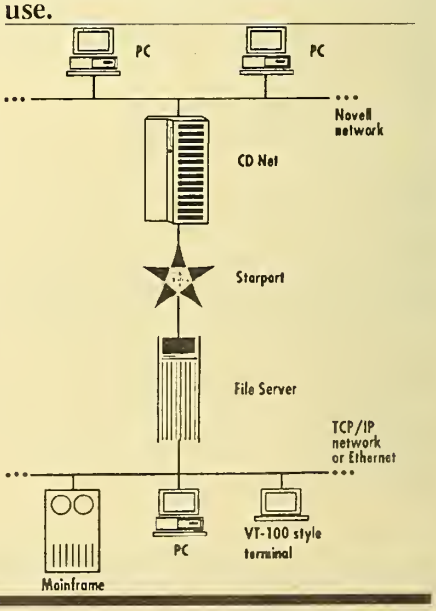
In-house CD-ROM development is now practicable and cost-effective for research institutions, such as the U.S. Forest Products Laboratory, to prepare information discs.

Bob Mosdal, staff member of NWPEP, is indexing and tagging the full text of 11 major FPL wood-based research publications for a custom disc. (*See Sidebar, p. 11*) Graphics and photographs (including full-color) are being scanned and linked to the text using a commercial Windows-based software retrieval program.

Information Distribution

Comprehensive CD-ROM full-text databases, such as the FPL disc, can be searched at individual microcomputer workstations.

Alternatively, a *library* of wood research information could also be accessed via CD-ROM disc network file servers. This provides a full range of opportunities for information management and use.



CD-ROM, from page 10

FPL CD-ROM Disc

Included will be the following 11 major FPL publications:

- AH 72 – Wood Handbook
- AH 607 – Tropical Timbers of the World
- AH 101 – Wood: Colors and Kinds
- AH 647 – Finishing Wood Exteriors
- AH 188 – Dry Kiln Operator's Manual
- AH 531 – Storage of Lumber
- AH 402 – Air Drying of Lumber
- AH 528 – Drying Eastern Hardwood Lumber
- AH 73 – Wood-Frame House Construction
- FPL–GTR-57 – Dry Kiln Schedules–
- FPL–GTR–60 – Chronicle of 65 Years of Wood Finishing Research

For more information and an indication of interest, contact:

Theodore A. Peterson or
F. Robert Mosdal

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330
or E-Mail:

Peterson_T@WISPLAN.UWEX.WISC.EDU

Feedback Still Needed

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know you specific needs within the NWPEP objectives (see p. 8). We will strive to be of assistance to you. *Pleas return this page to us.*

1. Correct the address label on reverse side of page if needed.

2. Indicate your E-MAIL address (e.g., Bitnet, Internet)

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3. Indicate your FAX number:

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5. Note your wood products resource information needs for more effective programming and technical assistance:

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National Wood Products Extension Program
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1 Gifford Pinchot Drive
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Feedback !

We hope *Extend* is serving your programming needs. Please share this information with your colleagues and clients.

Your feedback is appreciated —and needed! Please let us know how we are doing. The National Wood Products Extension Program stands ready to serve you better — but two-way communications is required. Thanks for taking time to give us your valued comments.

— NWPEP Program Leader

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 4 October 1991

Increased markets with value-added products

Dynamic NDT Lumber Testing

During the 1960's, the forest products research community devoted considerable effort to developing nondestructive testing (NDT) tools for evaluating the quality of lumber products. Out of this effort evolved a process of machine stress rating (MSR) lumber. The MSR process, as currently practiced in North America, couples visual sorting criteria with nondestructive measurements of the stiffness of a piece of lumber to assign an established grade to the lumber.

The most widely used tool in MSR of nominal 2-in.-thick lumber is based on a flatwise bending test. Stiffness is measured by using the load-deflection relationship of a simply supported beam loaded at its midspan. Machines determine modulus of elasticity (MOE) of specimens by (1) measuring the bending deflection resulting from a known load or (2) measuring the load required to deflect the specimen a given amount. Design stresses are determined from MOE values using a regression relationship between MOE and strength.

. . . new PC technologies (show) promise for making transverse vibration NDT tools available to a broader range of wood products manufacturers and users.

Other NDT tools have also been investigated for use in grading structural lumber. One of the most promising is based on measurement of MOE by transverse vibration. Transverse vibration NDT tools utilize the relationship between MOE and the frequency oscillation of a simply supported beam. This relationship is well known and can be obtained through a rigorous examination of fundamental mechanics.

. . . dynamic test results are highly correlated with the more costly static test equipment results.

In contrast to present MSR machines, transverse vibration NDT tools can be used on specimens thicker than nominal 2-in., panels, and specimens with nonrectangular cross sections. In addition, because transverse vibration NDT tools require that the weight of the specimen be known, gross density per volume or density per length can be calculated and used in strength regression analyses.

Continued on page 2

In This Issue:

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

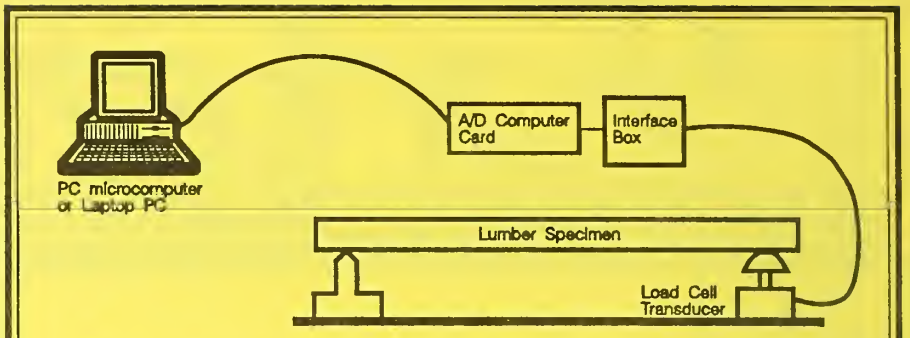
USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

Testing, *from page 1*

Commercially available tools were developed in 1978 that used the MOE-to-frequency-of-oscillation relationship through an innovative microprocessor-based electronics package. At that time, low-cost data acquisition and processing technology using a personal computer was not available. The new PC technologies have shown promise for making transverse vibration NDT tools available to a broader range of wood products manufacturers and users. The PC systems are available for a fraction of the cost of older electronic packages and from a wide range of suppliers.

FPL researchers developed a data acquisition system using a PC capable of gathering and analyzing information from a simple transverse vibration test. The sequence in which the necessary measurements are performed is controlled by software. This program is in the public domain and may be used by anyone for commercial or non-commercial purposes.



System for measuring and recording modulus of elasticity

FPL researchers examined the relationship between the MOE values obtained by transverse vibration measurements and static bending. Values were highly correlated and results compared favorably with transverse vibration results reported earlier by other scientists.

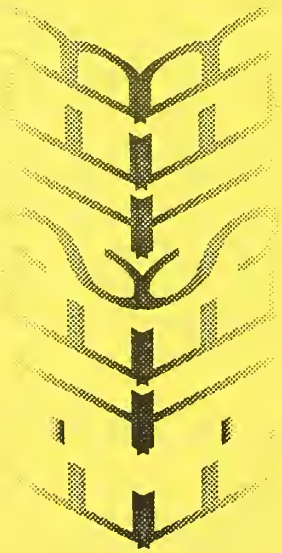
Details on the PC-based system and the research study results are included in FPL-RP-502 which is available from FPL. The applicability and potential of these recent research results are verified by the introduction of software/hardware packages for dynamic NDT transverse vibration testing by at least two commercial test equipment companies *(see E-TESTER below)*

For more information, contact:

Robert J. Ross,
Supervisory General Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9221

Reference

Ross, Robert J.; Geske, Earl A.; Larson, Gary R.; Murphy, Joseph F. 1991. *Transverse vibration nondestructive testing using a personal computer.* Res. Pap. FPL-RP-502. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 17 p.



Research results cometimes trigger early adoption of a new technology. That was certainly the case with FPL researchers who demonstrated the PC-based equipment and software to dynamically measure MOE by transverse vibration. In fact, at least two companies adapted the FPL research data acquisition and measurement technology and developed commercial packages before an FPL research publication was printed!

The cost-effective transverse vibration non-destructive testing provides the means to build quality into a broad range of products.

For further information about the known commercial dynamic E-tester products, contact:

Metriguard (E-Computer)
P.O. Box 399
Pullman, WA 99163
(509)332-7526

Qualtim Technologies International (DynaMOE)
5937 Meadowood Drive, Suite 7
Madison, WI 53711
(608)271-1176

Selection, Applications, and Finishes

Exterior Wood in the South

Wood continues to play an important role as a structural material in today's high-tech society. As lumber and in reconstituted products, wood is commonly used for house siding, trim, decks, fences, and countless other exterior and interior applications. When wood is exposed to the elements, particularly sunlight and moisture, special precautions must be taken in structural design as well as in the selection and application of the finish. This is especially true in the South, where excessive moisture can quickly damage a structure and erode the finish.

The information and advice given in this report provide a guide for obtaining maximum service life for finished exterior wood products in the South.

FPL-GTR-69, *Exterior Wood in the South:. . . .* describes the characteristics of wood finishes and their proper application to solid and reconstituted wood products. It describes how manufacturing and construction practices affect the surfaces of wood products, how various types of finishes interact with the surface, and how weathering affects the finished surfaces. Methods for selecting and applying various exterior wood finishes are presented.

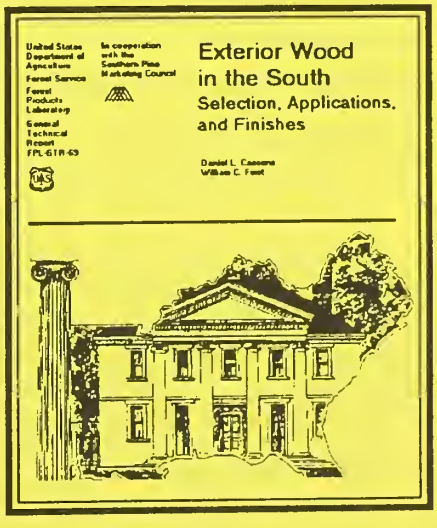
Finally, the failure and discoloration of wood finishes are discussed, and methods are described for preventing these problems. The information and advice given in this report provide a guide for obtaining maximum service life for finished exterior wood products in the South.

. . . excessive moisture can quickly damage a structure and erode the finish.

A limited number of free copies of FPL-GTR-69 are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

For further information, contact:

William C. Feist, Research Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9497



Exterior Textbases Available

The May 1991 issue of *Extend* announced the availability of the exterior wood finishing textbase (*Finish*) from the National Wood Products Extension Program at no cost. This textbase is based on AH-647, *Finishing Wood Exteriors:. . .* and uses the commercial retrieval software IZE, which runs on IBM-compatible microcomputers with a hard disk drive.

Another textbase has been prepared in the IZE-format based on the new FPL-GTR-69 publication, *Exterior Wood in the South: ..* and is available at no cost. Please send two formatted 5.25 inch or one 3.5 inch double-sided/double-density disks with your request.

A brochure *Exterior Wood Finishing* is also available which provides information on the four exterior finishing textbases which have been prepared and how to order the IZE software.

For more information, contact:

F.Robert Mosdal

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330 or E-Mail:
Mosdal@WISPLAN.UWEX.WISC.EDU

Recommendations for improved use of forest resources

Latin American Forest Products Almanac

Encouraging wise use of Latin America's forest resources may be the way to ensure their continued existence. A new publication by the USDA Forest Service - Forest Products Laboratory (FPL) provides a valuable reference tool for those planning the future of these tropical forests.

Forest Products from Latin America — An Almanac of the State of the Knowledge and the State of the Art (USDA Forest Service FPL-GTR-67) surveys what is currently known about the utilization of Latin American woods and recommends actions needed to further their wise use and conservation. Its thorough review of raw materials, processing technology and end uses of wood is based on a world literature review and the findings of a 1986 study team that traveled extensively throughout Latin America.

"This almanac is one of the first publications to examine the issures specific to Latin America," said Robert Maeglin, the publication's editor and a retired FPL researcher. "We hope that individual countries and regions will use it to assist in their oun programs and priorities."

*Forest Products from Latin America . . .*discusses both primary and secondary processing by product areas. It includes a list of references, bibliography, and condensed tree species lists. It also includes recommendations on new initiatives and programs that are needed in the areas of research, technology transfer, and training.

. . . surveys what is currently known about the utilization of Latin American woods and recommends actions needed to further their wise use and conservation.

A limited number of free copies of this publication are available to the public from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

(From FPL Press Release)

For more information, contact:

Gary Lindell, Program Manager
International Forest Products
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9500

Bibliography of research from 1910 - 1989

FPL Tropical Forest Utilization Research

The Forest Products Laboratory (FPL) officially opened on June 4, 1910. Research at the FPL was directed toward the use of both softwood and hardwood species grown and used in the United States. From the beginning research has also often been related to problems associated with the use of tropical woods. In the ensuing years, considerable research on tropical woods has been conducted at the FPL and continues today.

FPL-GTR-66, *Bibliography of FPL Tropical Forest Utilization Research — 1910 to 1989* lists published and unpublished reports generated by the USDA-Forest Service-Forest Products Laboratory from 1910 to 1989, relating to the use of tropical timber.

Continued on page 12

Research on Taxol extractives from Pacific Yew

Anticancer Drug Taxol

Availability of the anticancer drug taxol may be increased as a result of work started last week at the USDA Forest Service - Forest Products Laboratory (FPL). FPL scientists received a Pacific yew log from the Umpqua National Forest, Oregon, to begin research aimed at extracting taxol from the wood as well as the bark of Pacific yew.

Taxol has shown promise as a treatment for ovarian cancer, and may also be useful in treating breast, lung, and colon cancer. Currently, taxol is derived from Pacific yew bark, which comprises less than 1/8 -inch of the outer layer of the tree. The extremely small quantity available from each tree limits the amount available for clinical trials.

FPL chemical engineer Raj Atalla and chemist John Obst will explore better ways of extracting taxol from the tree's heartwood. The taxol concentration in the heartwood appears to be less than that in the bark, but a Pacific yew contains 50 to 100 times more heartwood than bark.

Taxol is derived from Pacific Yew bark

Pacific yew may contain a minimum of ten times and as much as 100 times more taxol than is currently obtained from a tree, Atalla said. FPL researchers are likely to achieve this improved yield because of their knowledge of wood chemistry and fiber structure, he said.

Initial studies will verify the taxol concentrations in the heartwood. Tests will be performed on narrow slices from the 8-inch diameter, 180 year old log. This information will serve as the baseline for assessing the effectiveness of various extraction technologies.

Taxol has shown promise as a treatment for ovarian cancer. . .

Atalla and Obst propose to examine three extraction technologies. The first will reduce the size of the wood particle used with conventional extraction methods, which may improve yield. The second method will attempt to improve the solubility of the taxol molecule by adding various chemical couplers. The third method will improve access to the taxol molecule by swelling the wood fiber to make it more porous.

The first year of this research program would cost $450,000. Promising results would warrant a multiyear extension of the program.

The research at FPL contributes to a larger Forest Service effort to protect Pacific yew populations while supporting taxol production and testing. In June, Secretary of Agriculture Edward Madigan signed a cooperative agreement with Bristol-Myers Squibb Company to increase the production of taxol from the bark of Pacific yew trees harvested from National Forest System lands. The agreement permits collection of Pacific yew bark while protecting forest ecosystems and the long-term viability of the species.

Current inventories estimate a population of 23 million yew scattered across 11.5 million acres of National Forest land in western Oregon and Washington and 6.5 million yew on 2.1 million acres of Bureau of Land Management land in the Pacific Northwest.

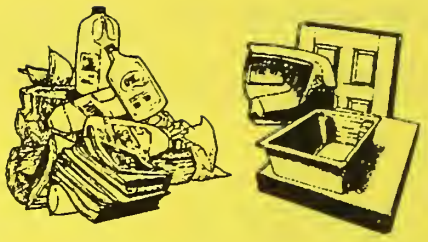
(From FPL Press Release)

For additional information, contact:

Rajae H. Atalla, Supervisory Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231 -9443

Opportunity for a variety of value-added products

Wood-Nonwood Composites



Combining wood with other materials to form new wood-nonwood composites is a very active research field. Researchers are investigating the properties of composites made by combining various species of wood, including aspen, with other biomass materials, metals, plastics, glass, and synthetic fibers. These new composites could be marketed as low-cost substitutes for more costly materials or in applications requiring specific performance attributes. These attributes can be superior to those of either the wood or nonwood component alone.

Wood-nonwood combinations have many advantages. The low density of lignocellulosics with plastic provides lighter weight products with potential for controlled biodegradeability and improved acoustical, impact, and heat-reformability properties. These features are possible at costs potentially lower than comparable plastics-only products, making them competitive for many applications. Lower-cost, recycled resins would make them even more competitive.

The composites' potential for improved properties also creates a market for a variety of value-added products. The wood component can be made from low-grade wood, wood residues, and recycled newspaper, which currently have limited commercial uses. The plastic component can come from recycled material, reducing a critical waste disposal problem.

Many wood-based products have been or could be displaced by new materials such as plastics, metals, cement products, and ceramics. The high efficiency achieved by many nonwood industries depends on improved process systems and the amenability of metals and plastics to high-speed automated machines. Some of these same high-speed processing concepts can effectively utilize wood in one form or another and are very amenable to high-speed processing. The Forest Products Laboratory is actively investigating two of these processing concepts.

These new composites could be marketed as low-cost substitutes for more costly materials . . .

One processing option for wood-plastic combinations is extrusion or injection molding technology. Thermoplastic resins are thoroughly mixed with finely ground wood fibers or flour, then forced through a die to form a sheet product. The sheet can be processed in a secondary manufacturing operation into a number of molded, corrugated, or shaped sections. This technology requires an optimum component mix before product formation.

Another processing option involves blending a high percentage of natural fibers with synthetic thermoplastic or thermosetting fibers to form a nonwoven mat. The mat can be handled in roll form, permitting automated handling and processing in subsequent operations. The mat composition can be varied to produce products with specific desired characteristics. After forming, the mat can be fabricated into panel products or deep-drawn molded configurations.

The increased processing flexibility inherent in both the extrusion and nonwoven technologies creates a host of "new" natural fiber/synthetic fiber products. Their thickness can range from a material as thin as 3 mm to structural panels several centimeters thick. The many possible configurations fall into three major classes: packaging products, manufactured products, and corrugated or sandwich-type configurations for floor, wall, and/or roof components. A broad range of cost-effective, value-added products could be produced for each of these applications using different combinations of raw materials to produce unique performance properties.

(From FPL Techline)

For more information, contact:

John A. Youngquist, Project Leader and Research Engineer
George Myers, Research Chemist
Roger Rowell, Team Leader and Research Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9200

Understanding the effects of moisture

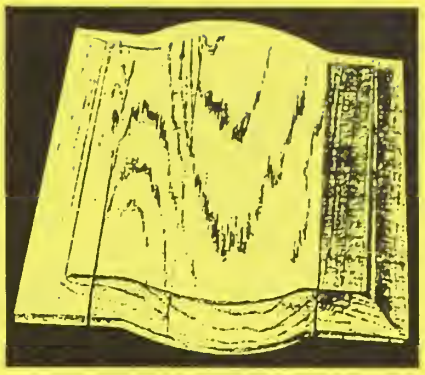
Wood Panel Delamination

Typically, defective joints are delaminated at one or both ends of a panel. In severe cases, the entire length of the glueline may be delaminated. Inspection of failed surfaces reveals certain characteristics. On a fine-texture softwood like white pine or diffuse-porous hardwood like maple, the failed surface feels relatively smooth; inspection with the unaided eye reveals little or no glue on the failed surface. On a ring-porous hardwood like oak, the failed surface may not be smooth because of glue castings of the large vessels or pullout of weaker earlywood tissue. Inspection with a microscope or a 10- to 15-power hand lens may reveal no visible glue film or a glueline consisting of bubbles or foam. If the panel has already been finished, stain may be evident. If an unfailed portion of such joints is viewed from the edge under a microscope or hand lens, no glue will be visible. Joints like these are called *starved* joints.

In a *starved* joint, most glue has been squeezed out of the joint so that not enough remains to form a continuous film between the wood members. The glueline is discontinuous, and its strength depends upon relatively few strands of glue extending from one wood surface to the other. The strands between the two wood surfaces can be a very small percentage of the total bond area. The strength of a starved joint (that has not yet delaminated) is only a fraction of the strength of a proper joint with a continuous film of glue. In tests, shear strength specimens cut from a joint averaged 1,005 lb/in^2, and no wood failure occurred. A well-made joint should have a strength of more than 2,500 lb/in^2 and exhibit 50 percent or more wood failure.

Three principal factors contribute to the formation of starved joints: species, glue consistency, and clamping pressure.

Moisture, or rather, lack of moisture control in several stages of panel production can lead to weak joints that easily delaminate. Understanding the effects of moisture and minimizing moisture content variation are probably the most cost-effective measures for minimizing expensive failures in most types of glued wood assemblies.



For additional information, contact:

Bryan H. River, Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9208

Reference

River, Bryan H. 1991. *Delamination of edge-glued wood panels: Moisture effects.* Res. Note FPL-RN-0259. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 11 p.

memo

Current special project funding will enable the National Wood Products Extension Program (NWPEP) to continue through June 30, 1992. F. Robert Mosdal will provide program leadership after November 3, 1991 when Dr. Theodore A. Peterson retires. Please feel free to contact Bob about your wood products research information needs.

Additional funding is being sought to maintain this programming beyond spring-1992. We look forward to providing added useful forest products information and developing educational tools for you and your clientele. We will also be promoting information technologies to facilitate the timely accessing and distribution of strategic information.

This unique partnership between the Cooperative Extension System and the Forest Service — Forest Products Laboratory, if maintained and used, can provide critical support toall information providers in national problem areas, e.g., Rural Development, Waste Management, Water Quality, Recycling, Energy, Housing, and Environmental Stewardship. We look forward to a continued productive partnership.

From The Program Leader -

This issue highlights research information that can help resolve national problems, e.g., Rural Development, Waste Management, Recycling, Health, Housing, and Environmental Stewardship. Access to and adoption of research information by our clientele are critical to the resolution of our many daunting issues. The Cooperative Extension System information providers are a vital link in our partnership and technology transfer efforts to serve the public.

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program stands ready to assist you.

The National Wood Products ExtensionProgram (NWPEP) is currently funded as a 3-year special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison. Current funding will support NWPEP through June 30, 1992.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. In this way, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

Extend is produced in-house using the publishing tools available to users of IBM PCs and compatibles. Camera-ready copy of *Extend* was produced on an IBM-AT (386) PC, using a Viking I Moniterm full-page monitor for page composition. The issue was proofed on an Apple Laserwriter Plus Postscript printer. Manuscripts were entered using Microsoft Word For Windows. Pages were composed in PageMaker 4.0.

Some graphics were created in Corel Headlines and CorelDraw and imported as EPS files. Images were scanned with Kurzweil 5100 and Microtek 300A scanners and imported as TIFF files. The fonts used are Postscript versions of TimesRoman and Helvetica from Adobe Systems.

The entire PageMaker file can be 'printed to disk' as a Postscript file, significantly compressed(up to 90%), and transferred via E-MAIL - complete with text and graphics as you see in this printed edition. This opens up other tremendous opportunities for information distribution - beyond generic text - on the CES Communications network using NSFNET and Internet.

Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(608)231-9330;
FTS 384-5330;
FAX (608)231-9592;

EMAIL:
Peterson_T@WISPLAN.UWEX.WISC.EDU
Mosdal@WISPLAN.UWEX.WIS.EDU

Low cost bonding materials from renewable materials

Wood Adhesives!

Adhesives are extremely important to the forest products industry in the United States and in other countries. Over the last 40 years, the use of adhesive-bonded wood products increased dramatically, due largely to the ready availability of low-cost adhesives. Adhesives have increased utilization of the diverse and changing U.S. wood resource and permitted economic production of new, often better, wood products, many of which cannot be made from solid wood.

About 30 to 40 percent of all harvested roundwood ends up in bonded wood panel products, such as plywood and other laminated veneer products, particleboard, wafer board, oriented strandboard, and fiberboard. In 1987, the production of panel products was valued at $5 to $8 billion, not including the value added by secondary or tertiary processing. Most of these materials are used in the building and construction industries. Thus, their manufacture is very important to the U.S. economy and to people's daily lives.

At present, petroleum and natural gas are the primary sources of raw materials for wood adhesives. Prices for these nonrenewable resources have stabilized since the disruptions of the 1970s. But, the strong petrochemicals market of recent years has tightened adhesive raw material supplies and driven prices sharply higher, in some cases as much as 50 to 100 percent higher. Eventually, supplies of petroleum and natural gas will diminish and prices will continue to rise. The forest products industry will need alternative sources of adhesives in order to continue manufacturing durable, bonded-wood products in the future.

The forest products industry will need alternative sources of adhesives . . .

Researchers at the Forest Products Laboratory are investigating the use of renewable raw materials (biomass) as sources of wood adhesives. The three basic strategies being pursued are: (1) partial replacement (20 to 50 percent) of petroleum materials used in conventional adhesives, (2) synthesis of totally new polymeric adhesive systems, and (3) production of raw materials currently used in adhesives from renewable resources instead of nonrenewable petrochemical sources. The new adhesives developed through this long-term research will be tested to ensure that they serve the forest products industry as well as the current petrochemical-based adhesives.

(From FPL Techline)

For additional information, contact:

Anthony H. Conner,
Research Chemist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53707-2398
(608)231-9211

References

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Overcoming adhesive-preservative incompatibility

Bonding Treated Wood

Today's wood products market lacks adhesively bonded lumber and composite products treated with preservatives. The problem arises because present commercial adhesives will not adhere to surfaces treated with waterborne-salt preservatives, such as chromated-copper-arsenate (CCA). Researchers at the Forest Products Laboratory (FPL) are seeking the causes of this incompatibility and ways to overcome it.

The problem is economically significant. Treated wood production fueled this decade's fastest growing segment of the southern pine lumber industry. The market in CCA-treated southern pine now accounts for almost one-half of the total southern pine lumber production. Wood treated with CCA preservatives constitutes about 80 percent of the treated-wood market in the United States.

The difficulties in bonding wood that has already been treated, and the degradation that occurs when a product is treated after bonding, hinder development of preservative-treated bonded lumber and composite products. The potential uses for new products from adhesively bonded lumber, veneer, flakes, and fibers that have been protected from biological deterioration are many and the potential demand is high.

Present commercial adhesives will not adhere to surfaces treated with waterborne-salt preservatives . . .

FPL researchers are investigating along three approaches to overcoming adhesive-preservative incompatibility. They are identifying physical and chemical causes of interference, identifying new and lesser-used preservatives that may be compatible with commercial adhesives, and improving adhesion to treated wood. Improved adhesion may be achieved by developing new adhesive formulations, investigating existing but untried adhesives, and exploring surface activators and adhesion promoters.

(From FPL Techline)

For additional information, contact:

Charles B. Vick, Research Forest Products Technologist
USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9295

Electronic communication systems provide tremendous opportunities for the Cooperative Extension System (CES) in our global information economy. Information technologies make it possible *now* to begin to access and distribute strategic information quickly and efficiently.

Did you know the CES is currently connected nationwide in a computer communications network via Internet? There are also gateways and links to other countries for international contacts and exchanges.

Contact your state Extension computer coordinator or university computer center. You too can access this network and realize its potential.

Send us your E-MAIL address. NWPEP staff want to share forest products research information, e.g., newsletters, databases, and images, with you to meet your clientele needs.

FPL CD-ROM

The CD-ROM disc recently completed to demonstrate in-house pre-mastering of the data, includes 12 (not 11 as previously noted) major FPL publications on wood subjects:

- AH 72 — Wood Handbook
- AH 607 — Tropical Timbers of the World
- AH 101 — Wood: Colors and Kinds
- AH 647 — Finishing Wood Exteriors
- AH 188 — Dry Kiln Operator's Manual
- AH 531 — Storage of Lumber
- AH 402 —Air Drying of Lumber
- AH 528 — Drying Eastern Hardwood Lumber
- AH 73 — Wood-Frame House Construction
- FPL-GTR-57 — Dry Kiln Schedules . . .
- FPL-GTR-60 — Chronicle of 65 Years of Wood Finishing Research
- FPL-GTR-69 — Exterior Wood in the South . . .

For more information and to make an indication of interest, contact:

F. Robert Mosdal or
Theodore A. Peterson

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9330
or E-MAIL:
Mosdal@WISPLAN.UWEX.WISC.EDU
Peterson_T@WISPLAN.UWEX.WISC.EDU

Feedback Still Needed

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know you specific needs within the NWPEP objectives (see p. 8). We will strive to be of assistance to you. *Please photocopy and return this page to us.*

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Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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Tropical, *from page 4*

It represents an effort to identify information that could help protect and promote the future productivity of tropical forests in Latin America through efficient utilization practices.

The references are listed chronologically within 11 major categories: wood anatomy and mechanical properties, chemistry, engineering, energy, pulp and paper, sawing and drying, veneer and plywood, wood preservation, hardboard and particleboard, general utilization, and miscellaneous. An abstract follows every refefence citation.

A limited number of free copies of FPL-GTR-66 are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 5 January/February 1992

Potential impact of Forest Service research

Research Support For Rural Wood Industry

This report evaluates the potential impact of USDA Forest Service wood utilization and wood energy research on rural employment and income. Recent projections suggest employment will decrease in many forest products industries, such as softwood sawmilling, but will eventually increase in softwood plywood and reconstituted panel mills.

In This Issue:

Forest products industries expected to provide wages exceeding the average manufacturing production wage include logging, softwood sawmills, millwork, softwood plywood-veneer, structural wood members, particleboard, wood partitions, pulp mills, paper mills, and paper board mills.

Industries expected to pay 90 percent of the average manufacturing production wage include wood kitchen cabinets, mobile homes, prefabricated wood buildings, and wood preservatives.

Projected employment increases are virtually all in timber-oriented industries or industries

. . . rural areas need not only economic growth (more jobs and income) but also economic development (higher per capita income).

oriented to both timber and end-use markets. Location of forest products mills in rural areas will be influenced by the need to minimize transportation costs. Research on design and performance of wood structures may lead to the greatest increase in employment by 2020. Research on pulp, paper, and paperboard recycling may also increase employment as less paper is imported and more paper with recycled paper content is produced in the United States.

. . . Forest Service initiative to identify opportunities for rural development through economic diversification, using the forest resource as a base.

Research could lead to wood energy cost savings. If these cost savings were the same as a 3- to 5-percent increase in fossil fuel

Continued on page 2

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. . . Guidebook and checklist for kiln operators and management

Quality Drying of Softwood Lumber

The *IMPROVE* Lumber Drying Program is intended to increase awareness of the lumber drying system as a critical component in the manufacture of quality lumber. The goals of the program are to help mill personnel improve lumber drying quality by identifying sources of drying losses, both grade and volume. Operation of the dry kiln is only one factor that determines lumber drying quality.

. . . kiln operators or management can use [it] to readily evaluate drying quality.

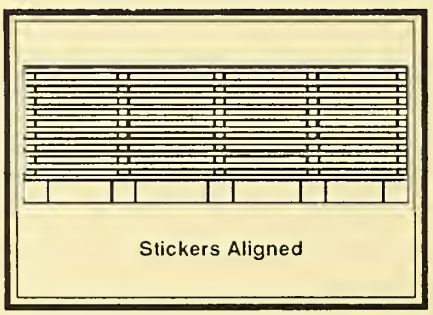
One objective of the *IMPROVE* Lumber Drying Program is to provide easy-to-use tools that a kiln operator can use routinely in daily work around the kilns without having to perform special studies or interfering with production. To help fulfill this objective, this report contains a complete guidebook — checklist for drying quality softwood lumber. The guidebook explains the importance of each item on the checklist and describes how to evaluate it. The guidebook also provides a quick reference on drying quality. Kiln operators can use the checklist to readily evaluate how well their operations rate on those factors that most strongly affect drying quality. Particular emphasis is given to kiln operation as well as maintenance and lumber handling.

In addition to the guidebook and checklist, Appendix 1. contains a summary checklist for easy duplication and filing. Appendix 2. contains the same checklist items but listed according to drying system components for convenience in checking individual components.

The guidebook / checklist is intended to be used with either steam-heated or direct-fired kilns. Chpt. 4. of the *"Dry Kiln Operator's Manual"* (Ag Handbook 188, revised 1991) also contains maintenance checklists and discusses many factors of kiln maintenance (see article on p.3 of *Extend*) . Kiln manufacturers can also supply maintenance checklists and additional information.

For additional information, contact:

R.Sidney Boone, Research Forest Products Technologist or
Jeanne D. Danielson, Supervisory Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9356 or (608)231-9351



Stickers Aligned

Reference

Milota, Michael R.; Boone, R. Sydney; Danielson, Jeanne D.; and Huber, Dean W. 1991. *Quality Drying of Softwood Lumber: Guidebook and Checklist.* Gen. Tech. Rep. FPL-IMP-GTR-1. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 50 p. (A limited number of free copies are available from the Forest Products Laboratory.)

Research, *from page 1*

prices nationwide by 2010, this would produce a net increase of about 5,200 jobs/year and $87 million/year in net income nationwide. These potential job and income changes related to wood energy use include direct job gains in wood burning operations, indirect job gains in the consumer sector, and indirect job losses in fossil fuel supply and end use.

A limited number of free copies of FPL-RP-506, *Supporting Rural Wood Industry Through Timber Utilization Research*, are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

For further information, contact:

Kenneth Skog, Research Forester
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9360

. . . a practical guide for kiln operator and mill manager

Dry Kiln Operator's Manual

The modern dry kiln is a unique product of research, development, and experience. The Forest Products Laboratory has been conducting research in lumber drying since it was established in 1910.

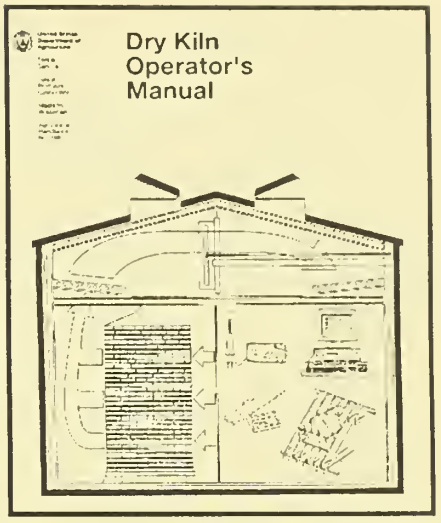
A well-designed and properly operated dry kiln can in a few days or weeks turn green lumber fresh from the forest into a dry, stable material necessary for successful industrial enterprises in today's highly competitive markets. The more critical the drying requirements, the more firmly the dry kiln becomes established as an integral part of the lumber mill, the furniture factory, or the millwork plant. For many wood products, kiln-dried lumber is essential.

The Forest Products Laboratory has been conducting research in lumber drying since it was established in 1910.

Dried lumber has many advantages over green lumber for producers and consumers alike. Removal of excess water reduces weight and thus shipping and handling costs. Proper drying confines shrinking and swelling of wood in use to manageable amounts under all but extreme conditions of relative humidity. Properly dried lumber can be cut to precise dimensions and machined more easily and efficiently; wood parts can be more securely fitted and fastened together with nails, screws, bolts, and adhesives; warping, splitting, checking, and other harmful effects of uncontrolled drying are largely eliminated; paint, varnish, and other finishes are more effectively applied and maintained; and decay hazards are eliminated if the wood is subsequently treated or protected from excessive moisture regain.

Efficient kiln drying of lumber is therefore of key importance in the utilization of our forest resource. On the one hand, it helps to assure continued markets for wood products by increasing their service life, improving their performance, and contributing to consumer satisfaction. On the other hand, it helps to conserve our forest resource by reducing waste in manufacture and extending service life and usefulness of products. Both are essential in using timber wisely, which has long been an accepted tenet of forest management policy.

The full benefits of modern kiln-drying technology can be gained only when certain prerequisites are observed. Mill management must recognize the importance of efficient operation to quality of product, and operators must be well trained and encouraged to apply the best techniques. Quality should not be sacrificed for quantity in the production of kiln-dried lumber. The high value of our timber resource makes it uneconomical to do so.



The modern dry kiln is a unique product of research, development, and experience. It is the only practical means now in wide use for rapid, high-volume drying of lumber to conditions necessary for maximum service-

The modern dry kiln is a unique product of research, development, and experience.

ability in housing, furniture, millwork, and many other wood products. As part of our charge to help further the efficient utilization of our nation's timber resource, Forest Service research and development in lumber drying has made a significant contribution to the technology. The Forest Products Laboratory (FPL) has been conducting research in lumber drying since it was established in 1910.

Early work by Harry Tiemann (*The Kiln Drying of Lumber: A Practical and Theoretical Treatise*, J.B. Lippincott Company, Philadelphia, PA, 1917) at FPL established lumber kiln-dry-

Continued on page 4

Dry Kiln, *from page 3*

ing technology and the first lumber dry kiln design. Tiemann's book can really be considered the first drying manual. Several other FPL drying manuals followed before the 1961 manual by Rasmussen.

The revised August 1991 edition of the USDA Forest Service, FPL, Agriculture Handbook No. 188 is now available for purchase from the Government Printing Office (GPO). This 274-page manual, edited by William Simpson of the FPL, is a revision of the 1961 edition by Edmund F. Rasmussen.

The purpose of this manual is to describe both the basic and practical aspects of kiln drying lumber. The manual is intended for several types of audiences. First and foremost, it is a practical guide for the kiln operator — a reference manual to turn to when questions arise. It is also intended for mill managers, so that they can see the importance and complexity of lumber drying and thus be able to offer kiln operators the support they need to do their job well. Finally, the manual is intended as a classroom text — either for a short course on lumber drying or for the wood technology curriculum in universities or technical colleges.

For additional information, contact:

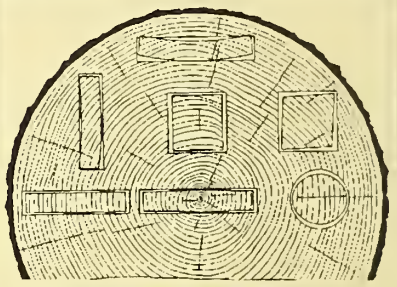
William T. Simpson, Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9357

A practical guide for quality drying

Drying Oak Lumber

Quality oak lumber has received premium prices in active domestic and foreign markets for over a decade. Drying facilities have been installed by many companies to provide a value-added product to meet market demands and to reduce transportation costs. The art and science of drying lumber, particularly the refractory species like oak, needs to be well-understood by kiln operators and management alike in order to be competitive in the global market.

The publication *Drying Oak Lumber* by Eugene M. Wengert, VPI Wood Products Extension Specialist, presents the latest information on correct techniques for handling, drying and storage of red and white oak lumber in order to reduce costs, increase profits and conserve our timber resources. The author brings together relevant information from published and unpublished sources and many years of practical teaching experience assisting the woodusing industry to provide an understandable procedure for drying oak lumber.



Typical Shrinkage in wood

Noteworthy is the introduction of quality control procedures and the analysis of drying defects to identify and correct problems in lumber handling, drying, and storage. These are important practices which management and labor must adopt to control the lumber manufacturing and utilization processes to truly by competitive in the marketplace.

Reference

Simpson, William T. 1991. *Dry Kiln Operator's Manual.* Ag Handbook 188 (revised). Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 274 p.

To obtain a copy, contact your local Government Printing Office (GPO) bookstore, or write: Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328 and request ISBN 0-16-035819-1. The price is $14.00 per copy.

Reference

Wengert, Eugene M. 1990. *Drying Oak Lumber.* Dept. of Forestry, Univ. of Wisconsin-Madison, Madison, WI 167 p.

Copies may be purchased from the Forestry Dept., UW-Madison, 1630 Linden Dr., 120 Russell Laboratories, Madison, WI 53706 for $30. (incl. postage & handling). Wisconsin residents add $1.50 state sales tax.

Selecting, specifying, and measuring fiberboard components

OptiCFC Expert System Software

Corrugated fiberboard consumes 31 million tons of fiber annually, including 10 million tons of recycled paper. Changes in motor and rail freight regulations will increasingly motivate the purchase and sale of corrugated containers based on their compression strength. The use of recycled and chemically strengthened paperboards creates virtually unlimited options for selecting, specifying, and measuring fiberboard components.

Forest Products Laboratory research on new theories related to the behavior of paper as a structural material has been incorporated within expert system software called OptiCFC for determining *O*ptimum paperboard combinations in *C*orrugated *F*iberboard *C*ontainers. The programs are intended to assist fiberboard producers and users in determining the lowest cost material combinations to meet performance-based strength requirements and to manage inventory and quality control.

Programs PPR, ECT, RSC, and CAL separate the overall problem of determining optimum paper properties into four specific stages. PPR converts paperboard test data into stress-strain properties. ECT predicts the edgewise compression strength of corrugated fiberboard. Then, given the fiberboard material and box dimensions, RSC predicts box compression strength for various loading directions and flute orientations.

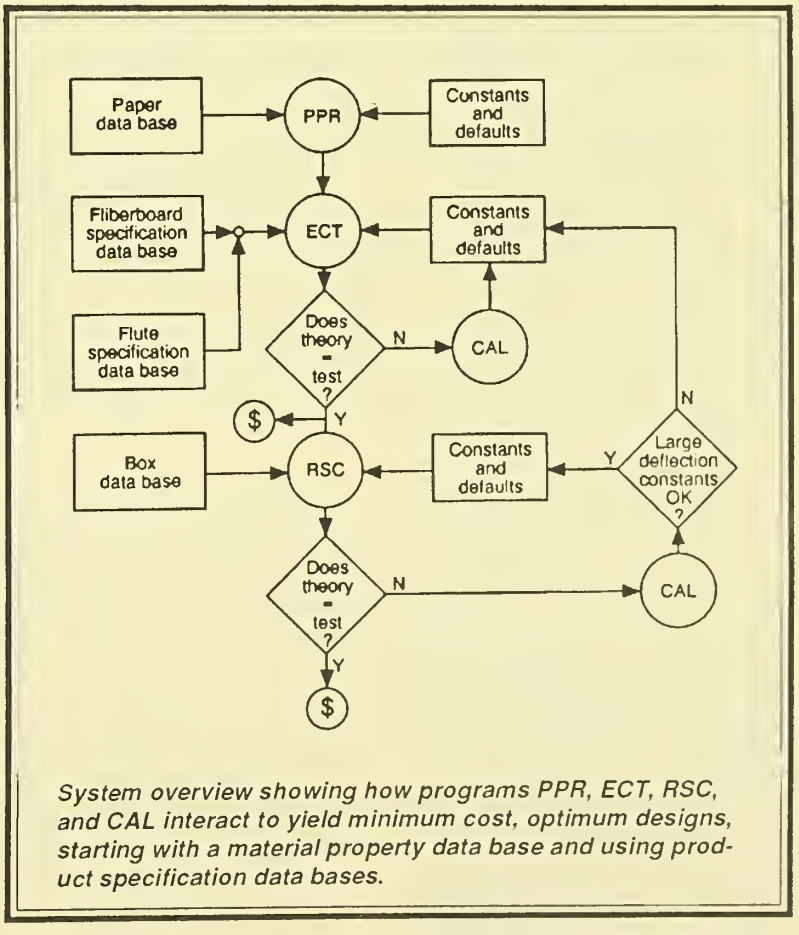
With PPR, ECT, and RSC, all the required inputs characterizing basic material properties and geometry can be measured with commercial instruments. Furthermore, the programs were developed to provide default inputs when given partial information, therefore broadening the predictability of box strength.

Programs assist fiberboard producers and users in determining the lowest cost material combinations to meet performance-based strength requirements . . .

Program CAL is a calibration program to adjust the postbuckling formulas used in ECT and RSC to account for differences resulting from laboratory testing methods and to introduce safety factors or variation allowances. CAL analyzes a data base of measured combined board crush strength and a data base of box strength for comparison with theory. The set of postbuckling constants that becomes recorded is a function of the input to PPR and therefore adjusts the program models to agree with each user's unique testing practices.

Continuing research at the Forest Products Laboratory is using OptiCFC software to relate container stacking life to paper properties under cyclic humidity conditions and to define optimum papermaking variables for end-product performance.

Continued on page 6



System overview showing how programs PPR, ECT, RSC, and CAL interact to yield minimum cost, optimum designs, starting with a material property data base and using product specification data bases.

Innovative methods to measure paperboard properties

Measuring Properties of Corrugated Containers

Corrugated container performance has traditionally been measured under constant loading and environmental conditions. Actual shipping conditions, however, can include dramatic variations in humidity exposure. Corrugated containers are the single largest use of paper and paperboard, and the effect of exposure to moisture is the most significant compression strength loss in container design.

Researchers at the Forest Products Laboratory have developed innovative methods to measure paperboard properties under the loading and environmental conditions expected in service. This new paperboard testing capability is a result of improved understanding of compression failure mechanisms for paperboard. Additional test apparatus developments for corrugated board and containers will allow evaluation of the duration of load, creep behavior, and moisture response of containers under a wide range of environmental conditions.

The testing facilities consist of climate-controlled chambers that simulate profiles of changing temperature and humidity experienced in any service environment. These environmental chambers house the mechanical testing equipment that, under computer control, monitors and loads the paperboard, corrugated board, and containers to simulate actual loading conditions. Research that uses these facilities is the key to developing a practical basis and rationale for evaluating materials and designing containers that provide adequate performance in the service environment.

A 3-year partnership with the American Paper Institute was initiated to develop a database of properties for virgin and recycled paperboard. This database will be used in writing design criteria for containers according to performance expectations and environmental exposures as they pass through their transportation and storage life.

References

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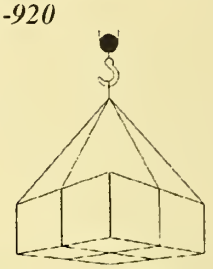
For more information, contact:

Theodore L. Laufenberg
Supervisory Research Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-920



OptiCFC, *from page 5*

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For more information, contact:

Thomas J. Urbanik,
Research General Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9428

Model accomodates multiple species and kiln schedules

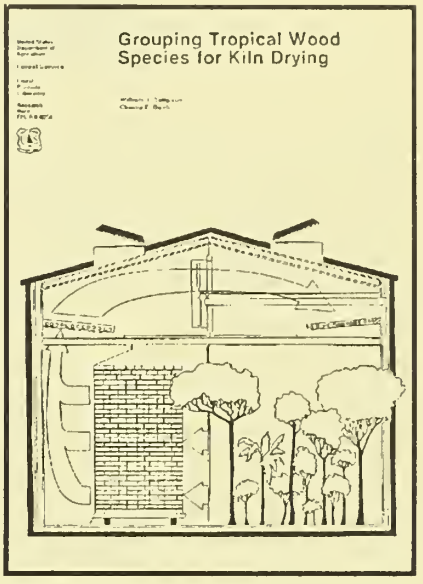
Grouping Tropical Wood Species for Kiln Drying

The most efficient method to kiln dry tropical hardwood species is in groups because of the large number of them and their diffuse occurrence in the forest. However, this large number of species presents a wide variety of drying properties, which makes it difficult to dry mixtures of species.

This report develops a mathematical model for grouping species by similar drying times. The goal is to kiln dry so all species will emerge from the same kiln at the same time within set limits of moisture content and with minimum drying defects.

The model, which utilizes experimental drying rate data collected in previously reported research, incorporates specific gravity and initial moisture content as criteria for grouping species based on estimated drying time. The model has not been tested in actual kiln drying studies but establishes the necessary framework to design such a study.

The model can be used to calculate multistep drying schedules that will minimize the range of final moisture contents after drying. A Fortran computer program is available for making the calculations of a multistep kiln schedule and printing the results. The program can accommodate multiple species and schedule steps. *Continued on page 12*



Using an estimated drying time index for species

Relative Drying Times of 650 Tropical Woods

Many tropical species are underutilized because of their varied and frequently unknown drying properties. When handling a large number of species, harvesting and processing the species individually is impractical, and grouping species by similar drying properties is difficult.

The report shows how these data, converted to green weight density, can be used to estimate drying times and thus to group tropical species by similar estimated drying times.

Data on green moisture content of tropical hardwoods have been reported in the literature, but the data are in many different sources, not all of which are easily accessible to potential users.

The report brings together some of these data and uses this expanded data base to confirm a previously developed relationship between basic specific gravity and green moisture content.

This relationship makes possible a first approximation at grouping tropical hardwoods by similar estimated drying times given only basic specific gravity or green weight density.

For further information, contact:

William T. Simpson, Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9357

Reference

Simpson, William T.; Sagoe, John A. 1991. *Relative drying times of 650 tropical woods: Estimation by green moisture content, specific gravity, and green weight density.* Gen. Tech. Rep. FPL-GTR-71. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 27 p.

From The Program Leader -

This issue highlights research information on wood drying. Proper practices enhance value-added returns for lumber producers and users and reduce raw material waste of our finite timber resources. The information can help resolve national problems, e.g. Rural Development, Waste Management, Housing, and Environmental Stewardship. Wood-using industry management as well as labor need to have access to and adopt current research information to be competitive in our global economy. The Cooperative Extension System information providers are a vital link in our partnership and technology transfer efforts to serve the public.

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program is ready to assist you.

The National Wood Products ExtensionProgram (NWPEP) is currently funded as a 3-year special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison. Current funding will support the NWPEP partnership through June 30, 1992. Continuation funding has been requested.

The major program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. By this partnership, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service and other research institutions.

Extend was edited and compiled by Dr. T.A. Peterson, Program Consultant, and produced in-house using the publishing tools available to users of IBM PCs and compatibles. Copy for *Extend* was produced on an IBM-AT (386) PC, using a Viking I Moniterm full-page monitor for page composition. Manuscripts were entered and pages composed in PageMaker 4.0. Camera-ready copy was proofed and prepared on an Apple Laserwriter Plus Postscript printer.

The entire PageMaker file can be 'printed to disk' as a Postscript file, significantly compressed(up to 90%), and transferred via E-MAIL - complete with text and graphics as you see in this printed edition. This opens up other tremendous opportunities for information distribution - beyond generic text - on the CES Communications network using NSFNET and Internet.

F. Robert Mosdal

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(608)231-9330;
FTS 384-5330;
FAX (608)231-9592;

EMAIL:
Mosdal@WISPLAN.UWEX.WIS.EDU
Peterson_T@WISPLAN.UWEX.WISC.EDU

Guidebook and checklist for kiln operators and management

Quality Drying of Hardwood Lumber

This report is another component of the *IMPROVE* Lumber Drying Program (see p. 2 – Quality Drying of Softwood Lumber).

The Guidebook–Checklist can assist kiln operators and management in the evaluation and maintenance of their dry kilns. By actually observing the items on the checklist you can accurately assess the kiln operation.

If changes are made that affect the drying operation, either at the kiln or in prior lumber handling, you can use the checklist to monitor how these changes affected drying quality. The before and after ratings can be compared to measure the effects of such changes.

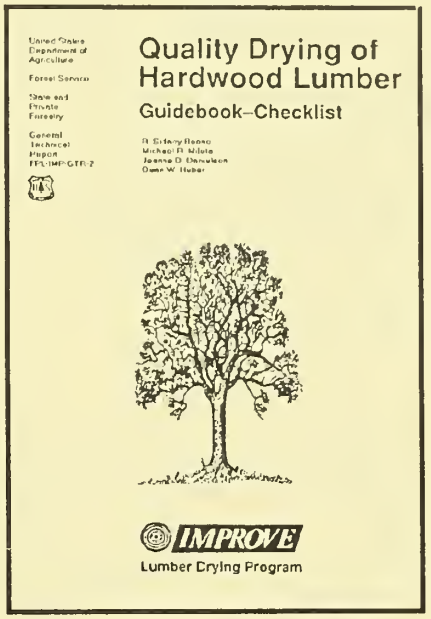
The checklist is arranged for monitoring by the area of the kiln or the yard. Questions are asked about standard operating procedures for the kiln and yard area — maintenance procedures and schedules, recordkeeping, and communications.

The checklist can point to possible problems associated with lumber drying defects. Quality lumber drying can increase the conversion efficiency of the timber resource and reduce the cost of lumber manufacturing and lumber used in final products.

For further information, contact

R. Sidney Boone, Research Forest Products Technologist or

Jeanne D. Danielson, Supervisory Research Forest Products Technologist Forest Products Laboratory One Gifford Pinchot Drive Madison, WI 53705-2398 (608)231-9356 or (608)231-9351



Reference

Boone, R. Sidney; Milota, Michael R.; Danielson, Jeanne D.; Huber, Dean W. 1991. *Quality Drying of Hardwood Lumber: Guidebook – Checklist.* Gen. Tech. Rep. FPL–IMP–GTR–2. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 56 p.

A limited number of free copies are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

Other Wood Drying Publications Available

Rietz, Raymond C. and Page, Rufus H. 1971 (Reprint 1983). *Air Drying of Lumber*, U.S. Dept. of Agric., Ag Handbook 402, 110 p.

McMillen, John M. and Wengert, Eugene M. 1978. *Drying Eastern Hardwood Lumber.* U.S. Dept. of Agric., Ag Handbook 528, 104 p. (Library of Congress Catalog Card #77-600073)

Rietz, Raymond C. 1978. *Storage of Lumber.* U.S. Dept. of Agric., Ag Handbook 531, 63 p. (Library of Congress Catalog Card #78-600012)

To purchase a copy of the above, contact your local Government Printing Office (GPO) bookstore, or write: Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328.

Boone, R. Sidney; Kozlik, Charles J.; Bois, Paul J.; Wengert, Eugene M. 1988. *Dry Kiln Schedules for Commercial Woods - temperate and tropical.* Gen. Tech. Rep. FPL-GTR-57. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 158p.

A limited number of free copies of this publication are available from the Forest Products Laboratory, One Gifford Pinchot Dr., Madison, WI 53705-2398.

Alleviating Tropical Deforestation

Tropical deforestation has reached alarming proportions and is cause for international concern. At the same time, tropical deforestation is interlinked with other international issues such as global warming.

Although the importance of tropical deforestation is widely recognized, the basic reasons behind it are more subtle. The root causes of deforestation are primarily social ones: abject poverty, population pressure, weak institutions, and uncontrolled development. Thus, efforts to arrest the situation through such things as the establishment of nature reserves or controls on the trade in tropical timbers do not address the root causes of the problem. As a matter of fact, they could even exacerbate the situation.

Tropical forests can only make a contribution to economic development if they are used. However, it is important that these forests be used in an efficient and sustainable way thus providing an economic incentive for their continued management. This can be achieved by improved utilization through research.

Research and Applications to Improve Forest Utilization

1. *Knowledge of Species Properties*

* research on the properties of lesser-known species is needed to optimize their processing and intended uses.

2. *Improved Recovery*

* domestic processing of timber for domestic and export markets can provide much needed employment.

* about 25% of the tropical timber exports are in log form, thus depriving the domestic economy of further value-added opportunities.

3. *Improved Processing*

* solar energy offers a low-cost, non-polluting method for drying lumber.

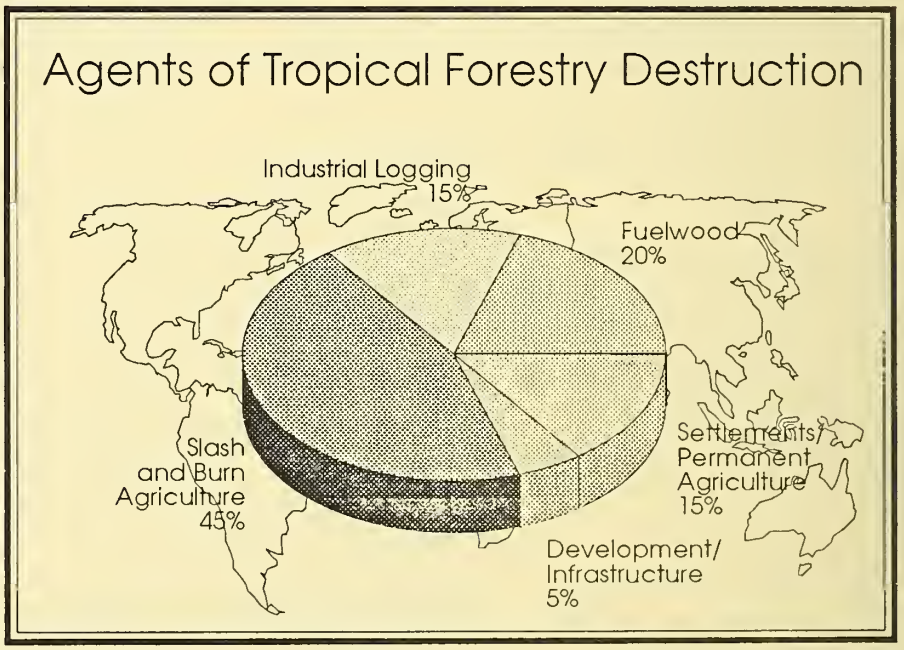
4. *Energy From Wood*

* fully one-third of the world's population relies on wood for domestic fuel. More appropriate and efficient stove designs and charcoaling techniques can help ease the demand.

5. *Shelter Designed for Tropical Climates*

* improved housing is a critical need in the tropics. Composite cement board panels can withstand harsh tropical conditions.

Continued on page 11



Causes of Deforestation

- Poverty
- Population Pressures
- Inequitable Land Distribution
- Inappropriate Development
- Overwhelmed Institutions

Tropical, *from page 10*

6. *Training for Researchers*

* training has been identified as a critical need for research institutes in the tropics.

For more information, contact:

Gary Lindell, Program Manager
International Forest Products Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9500

References

Boone, R. Sidney; Gjovik, Lee R.; Harpole, George B.; Laundrie, James F.; Maeglin, Robert R.; Wolfe, Ronald W. 1990. *Bibliography of FPL Tropical Forest Utilization Research - 1910–1989.* Gen. Tech. Rep. FPL–GTR–66. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 30 p.

Maeglin, Robert R.; ed. 1991. *Forest Products From Latin America — An almanac of the state of the knowledge and the state of the art.* Gen. Tech. Rep. FPL–GTR–67. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 151 p.

A limited number of free copies of these publications are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398.

Feedback Is Appreciated

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know you specific needs within the NWPEP objectives (see p. 8). We will strive to be of assistance to you. *Please copy and return this page and the reverse mailing label page to us.*

1. Correct the address label on reverse side of page if needed.

2. Indicate your E-MAIL address (e.g., Bitnet, Internet)
   _____

3. Indicate your FAX number:
   _____

4. Note your training needs in the wood products areas:
   _____
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5. Note your wood products information needs for more effective programming and technical assistance:
   _____
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6. Other comments:
   _____
   _____
   _____
   _____

Grouping, *from page 7*

For further information or the program listing, contact:

William T. Simpson, Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9357

Reference

Simpson, William T.; Baah, Charlie K. 1989. *A Method of Grouping Mixtures of Tropical Species for Kiln Drying.* Res. Note FPL-RN-0256. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 14 p.

National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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Feedback !

We hope *Extend* is serving your programming needs. Please share this information with your colleagues and clients.

Your feedback is appreciated —and needed! Please let us know how we are doing. The National Wood Products Extension Program stands ready to serve you better — but two-way communications is required. Thanks for taking time to give us your valued comments.

— NWPEP Program Leader

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 5 May/June 1992

Nondestructive Stress Wave Evaluation For Industry Use

Identifying Bacterially Infected Oak

Wetwood is an abnormal type of heartwood. Lumber containing wetwood is difficult to kiln dry without developing costly defects. Wetwood develops from the infection of living trees by anaerobic bacteria, decreasing the mechanical properties of wood. Consequently, oak lumber containing wetwood (also called bacterial oak) is more prone than normal (uninfected) oak lumber to develop honeycomb, ring shake, and deep surface checks when kiln dried under normal conditions.

It is difficult to recognize the presence of wetwood in lumber on the green chain during mill operation; therefore, the drying defects that develop in oak wetwood are unexpected. These unexpected drying defects in oak can be costly to the hardwood lumber industry. It is not easy to differentiate between various causes for drying defects. However, the Hardwood Research Council estimates that as a result of wetwood-related drying defects in oak lumber, losses can total as much as 1/2-billion board feet per year and cost as much as $25,000,000 per year.

Wetwood also limits the potential for lumber drying at accelerated schedules. Forest Products Laboratory (FPL) drying tests showed that accelerating kiln drying of red oak at elevated temperatures increases the incidence of honeycomb (a serious defect) in normal lumber. However, losses from honeycomb containing wetwood were three times greater than were similar losses for normal lumber.

A rapid, nondestructive evaluation (NDE) technique that can identify wetwood in oak lumber before drying could minimize these drying losses. If lumber containing wetwood could be detected and separated from normal wood, separate kiln drying schedules could be used to minimize drying defects. Wetwood in oak can now be detected with destructive, time-consuming laboratory tests, but a rapid, economical nondestructive test suitable for commercial operating conditions is needed.

Continued on page 2

The objective of this study was to determine the effectiveness of a stress wave nondestructive evaluation (NDE) technique to detect the presence of wetwood before kiln drying red and white oak lumber.

In This Issue:

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

Stress Wave, *from page 1*

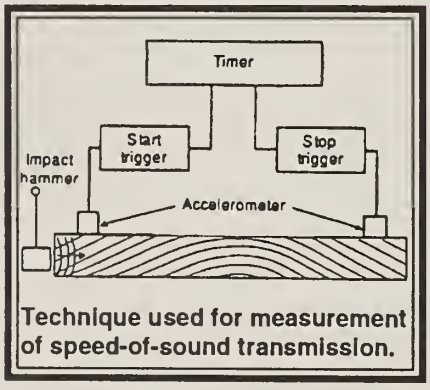
Several techniques have been investigated, including the use of green density to isolate defect-prone oak lumber. Forest Products Laboratory scientists have investigated the use of stress wave NDE techniques. Currently, these techniques are successfully used to evaluate the mechanical properties of a wide range of wood-based materials, and in the wood products industry, to grade veneer and evaluate wood structural components (reference E-Tester article in *Extend* Vol. 4, October 1991).

Stress wave NDE techniques use low-stress motions to measure two fundamental material properties: energy storage and dissipation. Energy storage is manifested as the speed at which a wave travels in a material; the rate at which a wave attenuates is an indication of energy dissipation.

A commonly used technique that employs stress wave NDE technology utilizes simple time-of-transmission measurements to determine speed of sound. The technique uses a mechanically or ultrasonically induced impact to impart a wave into a specimen. Piezo-electric sensors are placed at two points on the specimen and used to sense passing of the wave. The time it takes for the wave to travel between sensors is measured and used to compute wave propagation speed.

Stress wave NDE methods are commonly used in industrial applications for testing the properties of both wood and nonwood products. With nonwood manufactured materials (i.e., metals, polymers, ceramics, composites, and concrete), much of the NDE research effort has been qualitative and directed toward detecting intrinsic flaws that may occur in the manufacturing process. Nondestructive evaluation research and industrial applications with wood and wood-based products are concerned more with predicting the strength properties of wood than with detecting manufacturing flaws.

Because oak wetwood develops honeycomb and ring failure more readily than does normal wood during kiln drying, NDE tests to detect wetwood in oak should be designed to measure reductions in strength across the grain rather than along the grain. Honeycomb susceptibility suggests that bacterially infected oak has been weakened in strength perpendicular to the rays, and ring failure suggests a weakening at the interface of the earlywood with the latewood of the previous year.



Technique used for measurement of speed-of-sound transmission.

The objective of this FPL study was to determine if measuring speed-of-sound transmission across the width of boards would be an effective technique to detect the presence of wetwood before kiln drying red and white oak lumber.

Measurement of stress wave transit time across the width of green boards ranged from 140 to more than 300 µs per 7.5-in. span. FPL researchers found that transit times for bacterially infected heartwood of red and black oak lumber tended to be greater than 250µs, while normal heartwood usually had times less than 250µs. This corresponds with a stress wave speed of 2,500 ft/s. Differences in stress wave travel times between infected and normal wood were significantly greater than what would be expected from differences in ring orientation. However, this pattern was not as clear for white oak where stress wave transit times in infected wood were often less than 250µs and similar to transit times for normal heartwood.

For red oak, more than 93 percent of the normal boards and more than 82 percent of the severe bacterially infected boards were correctly identified. For white oak, more than 88 percent of the normal boards were correctly identified, but not more than 56 percent of the No. 1C severe bacterially infected boards. Successful identification of bacterially infected white oak in the No. 2C and No. 3C grades had an accuracy not greater than 71 percent. Mixed bacterially infected boards of both white and red oak were less easy to identify than were the normal boards and the severe bacterially infected boards.

Additional research is needed to explain the differences between stress wave transit times for bacterially infected heartwood of red and white oak. Differences between the bacterial populations in

Continued on page 3

Stress Wave, *from page 2*

red and white oak may be responsible for the dissimilarity of NDE stress wave measurements. The practical effectiveness and how to integrate this technique into a sawmill operation also needs to be examined.

For more information, contact:

Robert J. Ross,
Supervisory General Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9221

Reference

Ross, Robert J.; Ward, James C.; TenWolde, Anton. 1992. *Identifying bacterially infected oak by stress wave nondestructive evaluation.* Res. Pap. FPL-RP-512. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 6 p.

Feedback

We hope *Extend* is serving your programming needs. Please share this information with your colleagues and clients.

Your feedback is appreciated —and needed! Please let us know how we are doing. The National Wood Products Extension Program stands ready to serve you better — but two-way communications is required. Thanks for taking time to give us your valued comments.

— NWPEP Program Leader

Effect of preweathering wood before painting

Why Bother To Paint Wood Before It Weathers?

In the absence of adhesion failure, paint on wood exposed outdoors will gradually erode. Degradation of a paint coating by this mechanism takes several years and the erosion rate depends on exposure to sunlight and moisture and the thickness and type of paint.

During the time that paint is eroding, it still protects the wood substrate. Until this erosion proceeds to the point where the primer paint begins to show, the paint surface can easily be repainted with a topcoat. With timely repainting, painted wood can last for centuries.

If, however, the primer paint/wood interface fails, the paint film will degrade within a short time. This paint failure manifests itself as blistering, cracking and peeling. It could result in damage to the substrate and more difficult and costly refinishing. One cause of interface failure is a degraded wood surface caused by weathering prior to initial priming with paint.

Outdoor weathering of unprotected wood can cause severe surface degradation. Wood siding is often exposed to many weeks or months of weathering before being coated with paints, stains or other finishes (coatings).

This weathering before coating (called *preweathering* to differentiate it from weathering of the finished wood) can lead to chemical and physical changes on the wood surface that weaken the future coating/wood interface. This interface is crucial for adhesion of film-forming finishes and the performance of penetrating stains.

Recent research at the Forest Products Laboratory, as well as many studies at other laboratories, all lead to the same conclusion. Whether wood is to be painted, stained, or finished in any manner, preweathering for as little as 4 weeks is detrimental to the service life of the finish.

. . . preweathering for as little as 4 weeks is detrimental to the service life of the finish.

FPL researchers strongly recommend that any unprotected wood not be allowed to weather for more than a maximum of two weeks before it is protected with some finish that will prevent photodegradation and water damage. This recommendation is based on the observation that there was almost no wood/paint interface failure observed in western red cedar wood specimens that were weathered two weeks or less, and adhesion strengths were probably unaffected.

Continued on page 5

Where the world is going . . .

E-MAIL

Did you know that the Cooperative Extension System is currently connected in a communications network (Internet) via the national Land Grant and other educational institutions mainframe computers? There are also gateways and links to other countries for international contacts and exchanges.

Contact your State Extension computer coordinator or university computer center for assistance in accessing Internet.

Please send us your E-MAIL *address* (see p. 11, Item 2). NWPEP staff want to share forest products research information, e.g. research reports, newsletters such as *Extend*, databases, images, and more with you to meet your professional and clientele needs.

NWPEP is initiating the development of a *Forest Products Research Information site* at the U.S. Forest Products Laboratory for access via the Internet network. Plans include the timely, cost-effective access of databases and distribution of information.

As Cooperative Extension System *information providers*, you will want to be connected to the Internet communications network to be able to take advantage of its immense potential. It's up to you to make your connection — for that's the way the world is going!

A note from the corporate world

INTERNET

The best reason to be on the Internet is because this is where the world is going. There are millions of people, hundreds of thousands of computers, and thousands of networks. You can get to software, data, and people on the networks. Quite simply, this is the new global community. The networks are in place, they are cost-effective, and they are necessary. More than 3.5 million users are on the Internet and the network is growing exponentially. *Not being on the network is not being connected.* Granted, security is an issue, but it is not enough of an issue to make corporations into commercial hermits.

— Written by Carl Malamud
for *Communications Week*,
November 25, 1991

Preweathering, *from page 3*

With regard to preservative-treated wood — chromated copper arsenate (CCA) "the green colored lumber" — FPL researchers also recommend that it be finished as soon as possible after installation. The only requirements are that the wood should be clean and dry on the surface. Even wood that is saturated with water when it arrives at the construction site, should be dry enough on the surface to finish within a week or two. A minimum finish would be a water-repellent preservative.

The wood species that have been studied do not include all siding materials. The weathering characteristics of other substrates comprised of composite materials such as plywood and fiberboard have not been studied and could drastically affect service life. Additional research on these new materials and on new finishes for them is an ongoing challenge.

For further information, contact:

William C. Feist or
R. Sam Williams,
Research Chemists
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9200

Reference

Feist, W.C.; Williams, S.A. 1991
Why bother to paint wood before it weathers? American Paint and Coatings Journal 76(24): 38-48.

Applications for research information are not always evident or even recognized. Not so in the case of recent FPL research leading to the development of low cost stress rating technology for wood products application. Recent research on dynamic NDT Lumber Testing was reviewed in the October 1991 *Extend* newsletter.

Technology transfer of FPL research information . . .

FPL researchers developed and tested a computerized transverse vibration NDT prototype tool. Two companies quickly adapted the technology to manufacture and market commercial versions. A number of wood products manufacturers have already purchased the new equipment and use it to add quality, safety, and value to their products. Other units are being used to further research work.

Based on information received, between 15 and 20 units have already been sold by the two equipment manufacturers. At an estimated selling price of $4500, between $67,000 and $90,000 in additional sales were added to these equipment manufacturing firms during the first two years.

A primary benefit of this research technology is the ability to provide safe products for the consumer. In the case of scaffold planking, stress-rated lumber can reduce liability exposure at the job site. Each injury lawsuit avoided represents as much as $20 million saved to a scaffold planking producer.

In addition, this technology will provide significant savings in raw material required to produce a wide variety of quality, value-added wood products.

Continued on page 6

For further information, contact:

Robert J. Ross,
Supervisory General Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9221

E-Tester, *from page 5*

The Timely Application of FPL Research to Meet Customer Needs

. . . from Research to Application . . .

1989 -

Spring —
* Research began

Fall —
* FPL Research Poster Session

* Initial commercial model

1990 -

Spring —
* Additional commercial models

1991 -

Fall —
* Research Publication

1992 -

Spring —
* Value-added, safe, wood-based products in use

Research/Publication

Transverse Vibration NDT Using a Personal Computer

Ross, Geske, Larson, Murphy, FPL - RP - 502, August 1991

Equipment Manufacturers

*Qualtim Technologies, Inc. - "DynaMOE™"
(American Lumber Standards approved, April 1992)

* Metriguard - "Model 340 E - Computer"

Users of the Transverse Vibration NDT Equipment

* *Several solid sawn lumber/timber manufacturers*
* *Several consulting firms*
* *Inspection service company*
* *Universities*
* *Research organizations*
* *Resin manufacturer*

Value-added Products Being Made

* Structural materials - I-joists, laminated veneer lumber (LVL)
* Lumber, glued products evaluation
* Solid sawn structural members
* Scaffold planking
* Structural paper products, glulam

New Product Technologies

The United States urgently needs to reduce the quantity of municipal solid waste (MSW) going to landfills. In 1988, paper and paperboard, wood, and plastics accounted for nearly 60% of the MSW stream. This volume is expected to continue to grow. In addition to the wood fiber in MSW, the United States is burning, burying or otherwise disposing of vast quantities of low-grade wood, wood residues, and industry-generated wood waste in the form of sawdust, planer shavings, and chips.

The United States urgently needs to reduce the quantity of municipal solid waste (MSW) going into landfills.

Developing alternative uses for recovered materials helps solve the landfill problem and creates new materials that balance performance properties and costs. The USDA Forest Service is proposing a research program to explore the following new uses for recycled wood fiber.

Composite Products —

Examples of value-added composites made from waste materials include wood-nonwood composites, dry-formed wood fiber products, wet-formed molded pulp structural products, and composites fabricated with inorganic binders of gypsum, portland cement or magnesia cement.

Wood-nonwood composites include those made by combining various recycled wood fibers (or other biomass materials, metals, plastics, glass, and synthetic fibers) and synthetic resins or inorganic binders. Recycled plastics such as polyethylene, polypropylene, polyethylene terephthalate, other single plastic resins, as well as comingled thermoplastics, can be combined with recycled wood fiber to make useful, high-performance reinforced composite products, which can be molded into complex shapes for packaging furniture, housing or automobile components.

Dry-formed wood fiber composites can be made by recombining recycled or waste wood fibers under controlled conditions of hot pressing. Binding agents and other materials may be added during manufacture to create properties such as increased strength or resistance to fire and/or moisture.

Wet-formed molded pulp structural products can be produced by press-drying recycled fiber against compressible rubber molds. Using this technique, products can be made thin enough for strong, lightweight corrugated containers or thick enough for wall, floor, or furniture applications.

Recycled particles of wood fibers held together with an inorganic matrix, such as portland cement or gypsum, form a composite that can be used in a variety of structural and industrial applications. These composites combine the characteristics of both the wood fiber and mineral matrix and can offer unique advantages over some other conventional building materials, such as improved water resistance. Almost all of them are either fireproof or highly fire resistant, and are very resistant to attack by decay fungi.

Fibrous Wood/Plastic Mats —

Recovered waste wood fibers can also be used to make low-density mats for landscaping and nursery coverings, or higher density mats for filtering purposes.

Composting —

Recycled wood fiber can be composted with primary and secondary papermill sludges to make soil amendments and potting soil for greenhouses and nurseries.

Energy —

Energy is already recovered from refuse-derived fibers. However, residual fibers from new fiber processes and wood recovered from sorted demolition wood and used pallets and crates will increase the potential for recovering energy from MSW.

Continued on page 10

From The Program Leader -

This issue highlights research information on non-destructive testing (NDT) technology applicable to forest products industries.

Included is a model success-story involving the rapid commercial adaptation of FPL "E-Tester" research results and the significant value-added wood-based products emerging in the market-place. An early research progress report on the use of NDT to detect *wetwood* offers great promise to industry in coping with a persistent and costly hardwood problem. Finally, a comprehensive review of published NDT research is referenced.

Such information can help resolve national problems, e.g. Rural Development, Housing, and Environmental Stewardship. Wood-using industry management as well as labor need to have access to and adopt current research information to be competitive in our global economy. The nationwide Cooperative Extension System information providers are a vital link in our partnership and technology transfer efforts to serve the public.

To help develop expertise and networking among information providers and clientele groups, plan to attend the Annual Forest Products Research Conference at FPL, September 22-24, 1992.

This *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program is ready to assist you.

The National Wood Products ExtensionProgram (NWPEP) is currently completing an additional year for the 3-year special project. NWPEP has been funded by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the USDA-Forest Service, Forest Products Laboratory, Madison. Stable funding to continue the program after September 30, 1992 is being sought.

The major NWPEP program objective is to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System. Through this unique partnership, Extension can strongly augment the national wood products technology transfer efforts of the Forest Service and other research institutions.

Extend was edited and compiled by Dr. T.A. Peterson, Program Consultant, and produced in-house with publishing tools available to users of IBM PCs and compatibles.

The large Postscript file can be significantly compressed(up to 90%), and transferred via E-MAIL - complete with text and graphics as you see in this printed edition. This opens up other tremendous opportunities for information distribution - beyond generic text - on the national CES Communications network using NSFNET and Internet.

F. Robert Mosdal

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(608)231-9330;
FTS 384-5330;
FAX (608)231-9592;

EMAIL:
Mosdal@WISPLAN.UWEX.WISC.EDU
Peterson_T@WISPLAN.UWEX.WISC.EDU

FPL RESEARCH CONFERENCE

September 22 - 24, 1992 — Forest Products Laboratory, Madison, WI

"Adapting Forest Products Technologies to Revitalize Rural Economies"

The 1980's have hastened the demise of many family farms, and rural communities are suffering the loss of their youth and economic health. The USDA, Forest Service, is taking an active role in developing partnerships for a brighter future for rural America in the 90's.

This conference will bring local communities to the table with researchers to match the community problems and the research needs. Technology transfers of federal laboratory research through new coalitions will help promote sound economic development in rural communities.

The links between the federal research support systems, the rural resources, and forest products need to be translated into economic growth projects. Several panels will be exploring these opportunities. At the end of the conference regular break out sessions are planned to formulate coalitions and strategies.

Your insights and participation are most welcomed. Final information will be available soon.

Continued on page 10

Conference Objectives

- Demonstrate research capabilities of forest products research community, including specific new and emerging technologies and value-added opportunities
- Develop linkages between national, regional, and local interests in the field of forest products
- Discuss means and channels for getting information to people (technology transfer)
- Broaden participation and establish new coalitions
- Identify research needs and community problems

Program

- **Key Presenters —**

  Winthrop Rockefeller, *President's Council on Rural America*

  Richard Gardner *Idaho Governor's Office*

  Jim Ruch *Grand Canyon Trust*

- **Panel Discussions —**

  – *Opportunities and Obstacles in Rural Development*

  – *Matching Technology to Resources*

- **Technical Poster Sessions**

  – *Successes and Options in Rural Development*

- **Sessions —**

  – *Economic & Community Development*

  – *Wood Products and Other Forest-based Development Opportunities*

  – *Current and Emerging Technologies and Opportunities*

  – *Available Tools/Research and Technology Transfer Needs*

FPL Conference, *from page 9*

Benefits of Attending —

Interaction:

Share your thoughts, concerns and insights with rural development foundations, research institutions, government agencies, and environmental groups in both formal and informal settings.

Latest Scientific Information:

Hear presentations of research that offers opportunities for promoting economic development in rural communities.

Networking:

Meet and join with other people who are making rural development a reality.

For further information, contact:

Diann Campbell
FPR Conference Coordinator
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608) 231-9244

Making paper from recycled fibers

New Concepts for Fiber Bonding

The final stage in making paper on a papermachine is drying the sheet at relatively high temperatures. The combination of dehydration and elevated temperatures hardens the surface of the wood fibers and stiffens their internal structure. However, these effects must be reversed if the fibers are to be recycled into paper. In making paper from recycled fibers, surface hardening limits interfiber bonding, and internal stiffening reduces the fiber conformability needed for good consolidation of a paper web.

Variations on traditional refining and stock preparation can reverse internal stiffening for some applications. However, the surface hardening effect is not as readily reversed. Research at the Forest Products Laboratory focuses on two new approaches to reactivating the surface to enhance interfiber bonding.

In the first approach, FPL scientists are identifying processes that alter the physical surface structure by physical swelling transformations and in particular processes that alter the physical aggregation of cellulose and hemicelluloses. The focus is swelling agents that act only on the outermost surface layers of the pulp fibers and that avoid internal swelling, which can make fibers less conformable.

In the second approach, FPL scientists are assessing the possibilities of chemical modification of the fiber surface that can rehydrate the surface and enhance bonding associated with the presence of functional groups. These studies also emphasize confining the action to the surface of the fibers. The treatments currently contemplated are primarily oxidative ones that form highly polar groups on the surface cellulosic microfibrils. Such functional groups facilitate rehydration of the fibers and contribute to interfiber bonding due to the strong polar interactions they create. Although the initial focus will be on oxidative treatments, other approaches will be explored as well.

(From FPL Techline)

For additional information, contact:

Rajai H. Atalla,
Supervisory Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608) 231-9443

New Product, *from page 7*

The new product research being conducted within the Forest Service *recycling program initiative* is coordinated with other governmental agencies (including the Department of Energy and the Environmental Protection Agency), industry, and interest groups. As the research initiative progresses, the research is subjected to review by steering committees from private industry and other agencies and steering groups. Additionally, an integral portion of the program initiative is economic research to provide an ongoing basis for understanding and setting research priorities in the overall program, and to help facilitate the transfer and application of promising new research developments.

(From FPL Techline)

For additional information, contact:

John Youngquist,
Research Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608) 231-9398

NDT

The USDA Forest Service, Forest Products Laboratory (FPL), and Washington State University (WSU) have been actively developing nondestructive testing (NDT) techniques for wood products for more than 30 years. Their individual and combined efforts of research and technology transfer activities have yielded a variety of NDT tools and techniques that are commonly used by manufacturers and users of forest products throughout the world.

An FPL report presents a comprehensive review of published research on the development and use of NDT tools for in-place assessment of wood members. It examines the fundamental hypothesis behind NDT of wood, reviews several widely used NDT techniques, and summarizes results of projects that focused on laboratory verification of the fundamental hypothesis.

For more information, contact:

Robert J. Ross,
Supervisory General Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9221

Reference

Ross, Robert J.; Pellerin, Roy F. 1991. *Nondestructive testing for assessing wood members in structures: A review.* FPL-GTR-70. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 27p.

Feedback Is Appreciated

Please correct the mailing label if necessary and provide other information to enhance communication. In addition, let us know you specific needs within the NWPEP objective (see p. 8). We will strive to be of assistance to you. *Please copy and/or return this page and the reverse mailing label page to us.*

1. Correct the address label on reverse side of page, photocopy page and return to us .

2. Indicate your E-MAIL address (e.g., Bitnet, Internet)

   _____

3. Indicate your FAX number:

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4. Note your wood products information needs for more effective programming and technical assistance:

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5. Check:

   ☐ Send me the information brochure on 'Using CD-ROM for Information Management'

   ☐ I am interested in more information about obtaining the FPL CD-ROM Disc.

   ☐ Send me the brochure about the full-text databases on 'Exterior Wood Finishing' and how to obtain them (free).

6. Other comments/suggestions:

   _____

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National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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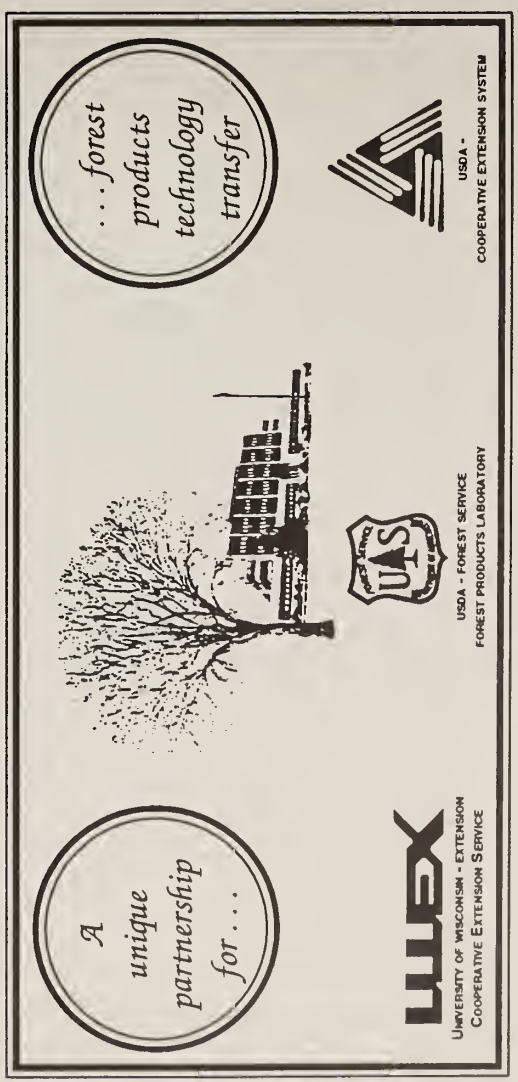


Attend the

Forest Products Research Conference

September 22-24, 1992

Forest Products Laboratory

Madison, Wisconsin

"Adapting Forest Products Technologies to Revitalize Rural Economies"

Extend Newsletter
May/June 1992

Extend
WOOD PRODUCTS TECHNOLOGY TRANSFER

Volume 5 September 1992

Using wood for bridges in rural America

National Timber Bridge Initiative

A significant opportunity exists in the U.S. to improve rural transportation networks and to revitalize rural economies by using wood for bridge construction. With about 40 percent of the 575,000 highway bridges across the nation in need of repair or replacement, a severe impact is being placed on the economy. One report, utilizing the U.S. Department of Transportation figures, stated that within the next four years the lost productivity resulting from bad roads and bridges will cause over a three percent decline in the Gross National Product, an eight percent increase in the Consumer Price Index, and over a two percent reduction in employment.

This crumbling infrastructure has created an opportunity in the U.S. to improve and revitalize rural economies by using wood for bridge construction. Many of these bridges, especially the ones on double lane, rural roads, are ideally suited for wood construction. Technological advances in the treatment, preservation, and design of wood make the timber bridge an economical, safe and attractive alternative to steel and concrete.

To address this opportunity, the U.S. Congress funded the National Timber Bridge Initiative, beginning in Fiscal Year 1989. The primary direction of the Initiative is to diversify local economies by:

Technological advances in the treatment, preservation, and design of wood make the timber bridge an economical, safe and attractive alternative to steel and concrete.

- Improving rural transportation networks
- Expanding the range of markets for wood products
- Creating service industries for wood bridge construction

Continued on page 2

In This Last Issue:

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN-EXTENSION

USDA - FOREST SERVICE
FOREST PRODUCTS LABORATORY

COOPERATIVE EXTENSION
SYSTEM

Timber Bridge, *from page 1*

This direction is being achieved through four distinct, yet interrelated goals:

Demonstration Timber Bridges

. . . to stimulate awareness of viable, efficient alternatives to traditional bridge construction techniques and materials.

Research

. . . to optimize the balance between existing and developing technology in the use of wood as a construction material.

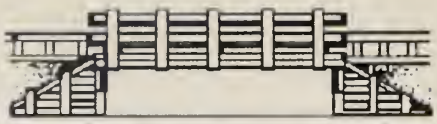
Technology Transfer and Information Management

. . . to develop and manage information about wood in transportation and transfer this information and technology to a wide-range of users.

Rural Revitalization

. . . to stabilize and revitalize the economic well-being of rural economies through service industry development and market expansion.

Information on two of the National Timber Bridge Initiative goals follows:



Demonstration Timber Bridges

Construction of bridges from locally available timber resources is the key to this goal. Demonstration bridges have proven very effective in creating awareness of viable alternatives to concrete and steel construction while stimulating local industry. Generally, timber bridges cost less than a comparable structure made of concrete and steel. This is primarily due to:

- Lower materials and construction costs
- Lower maintenance costs
- Lower life-cycle costs

Accordingly, the use of wood as a construction material makes sound economic sense. This, in turn, provides an incentive to market previously underutilized wood thereby diversifying local economies. An environmental benefit of this improved use of wood is the overall improvement of the forest resource — *stewardship*.

Since the implementation of the National Timber Bridge Initiative in 1989, 223 vehicular bridges in 48 states and the District of Columbia have been funded. As of April 1992, about one-half of these have been completed and are in service, carrying a full range of traffic loads.

In response to growing public demand to expand the use of the modern timber bridge technology in towns and small communities, the program funded twelve pedestrian bridges in 1992. This brings the total number of wooden bridges approved for funding under the guidelines of the Initiative to 235.

The selection of Demonstration Timber Bridges is based on a highly competitive proposal process. The selection criteria include structural integrity, use of local labor and wood species, innovative design, and conformance of standards of the American Association of State Highway Transportation Officials (AASHTO), as appropriate.

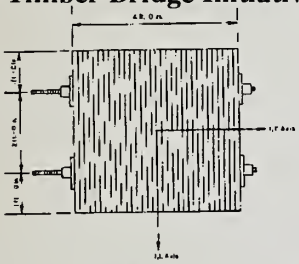
The design of most of the bridges consists of placing timbers on edge and holding them together by running threaded steel rods from one side to the other. Another type of design utilizes wooden timbers that are glued instead of bolted together. Demonstration Timber Bridges have been constructed of hardwood, softwood, and even a combination of the two.

In West Virginia, cost data from the 1989 demonstration stress-laminated bridges are being evaluated. Initial findings indicate that these experimental hardwood bridges provided a cost-savings when constructed by local government crews. Additional cost-savings can be gained through increased competition and experienced timber bridge contractors, improved design to utilize the most economical materials locally available, and developed modular bridges for the construction of stress-laminated hard-

Continued on page 3

Timber Bridge, *from page 2*
wood bridges.

In addition to the Demonstration Timber Bridges, wooden bridges are also being emphasized on National Forest System (NFS) lands. Since 1989, 216 bridges on the NFS transportation system have been constructed of wood at a cost of about $11.5 million. This expenditure is outside of the funds provided under the National Timber Bridge Initiative.



Research

This goal is designed to develop an optimal balance between existing structural systems and methods and the development of new technology. Major research activities include:

- Maximizing the availability of new technology for local users
- Improving design standards and construction procedures
- Cost versus benefits of timber, concrete, and steel construction
- Cost versus benefits of rural development through renewable resources

The focus of the Research effort is the Forest Products Laboratory located at Madison, WI.

See **FPL Timber Bridge Research,** *on p. 4 for additional information.*

Much of the work is cooperative in nature, including collaborative activities with West Virginia University, University of Nebraska, University of Wisconsin, Mississippi State University, and Georgia Southern University.

The Initiative is providing a new opportunity for universities to design and develop new timber bridge systems. This research effort has provided the provisional adoption of the innovative stress-deck design criteria by the American Association of State Highway and Transportation Officials (AASHTO). This adoption provides uniform standards for slab deck designs across the country.

Timber bridge research continues on longer spans using components of local hardwood. Crash test research also continues on high performance railing attached to timber bridge decks. This research is preparatory to presentation of design criteria to the AASHTO Bridge Committee over the next several years.

An important component of the Research effort is monitoring the performance of selected Demonstration Timber Bridges and bridges on National Forest System lands. Monitoring activities for each bridge typically include a two-year assessment of wood moisture content and rod stress levels, one or more load tests and intensive visual inspections. Bridge monitoring is currently in progress to assess the field performance of stress-laminated bridges in West Virginia, including stress-laminated decks, T sections and box sections. Information obtained on T and box section performance will serve as a basis for continuing research and the development of design criteria for these systems. In Pennsylvania, field performance of seventeen bridges will be monitored. The information obtained from these activities is being used to develop improvements in design procedures, fabrication, construction, and erection methodologies.

Research continues on the yield of structural lumber grades of northern red oak, hickory, red maple, yellow poplar, and beech. The objective of these studies is to identify a source of hardwood structural lumber that is competitive with the sources used by other woodusing industries and can thus be significantly less expensive.

(From FY92 Status Report, The Timber Bridge Initiative)

For additional information contact:

National Timber Bridge
Information Resource Center
Northeastern Area
State and Private Forestry
USDA, Forest Service
180 Canfield Street
Morgantown, WV 26505

(304)291-1591

Reference

Status Report
The Timber Bridge Initiative
Fiscal Year 1992

(available from above Information Resource Center)

Research reports published since 1989

FPL Timber Bridge Research

Dimakis, A.G.; Oliva, M.G.; Ritter, M.A. 1992. *Behavior of stress-laminated parallel-chord timber bridge decks: Experimental and analytical studies.* Res. Pap. FPL-RP-511. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 24 p.

McCutcheon, W.J. 1992. *The Mormon Creek bridge. Performance after three years.* Res. Pap. FPL-RP-509. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 8 p.

Moody, R.C.; Ritter, M.A.; GangaRao, H. 1990. *Applications of wood materials for innovative bridge systems.* In: Suprenant, B.A. ed. Serviceability and Durability of Construction Materials: Proceedings, 1st Materials Engineering Congress; 1990 August 13-15; Denver, CO. New York: American Society of Civil Engineers 1:423-432.

Oliva, M.G.; Dimakis, A.G.; Ritter, M.A.; Tuomi, R.L. 1990. *Stress-laminated wood bridge decks.* Res. Pap. FPL-495. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory.

Ritter, M.A. 1990. *Timber bridges: design, construction, inspection, and maintenance.* EM 7700-8. Washington, DC: U.S. Dept. of Agric., Forest Service. 944 p.

Ritter, M.A. 1990. *AASHTO to publish stress-laminated deck design criteria.* Wood Design Focus 1(3): 2.

Ritter, M.A.; Geske, E.A.; Mason, L.; McCutcheon, W.J.; Moody, R.C.; Wacker, J. 1990. *Performance of stress-laminated bridges.* Wood Design Focus 1(3): 12-16.

Ritter, M.A.; Oliva, M.G.; 1990. *Field performance of U.S. stress-laminated wood bridges.* In: Sugiyama, H., ed. Proceedings of the 1990 international timber engineering conference; 1990 Oct. 23-25; Tokyo. Tokyo: Steering committee of the international timber engineering conference; 1990: 654-569. Vol. 2.

Ritter, M.A.; Post, E.R.; Faller, R.K. 1990. *Vehicular railing systems for timber bridges: program overview.* Wood Design Focus 1(4): 4-7.

Ritter, M.A.; Post, E.R.; Faller, R.K. 1991. *Crashworthy railing systems for timber bridge decks.* In: Structures congress '91 compact papers; 9th structures congress proceedings; 1991 April 29-May 1; Indianapolis, IN. New York: American Society of Civil Engineers: 540-543.

Ritter, M.A.; Williamson, T.G. 1991. *LRFD design for wood bridges.* In: Structures congress '91 compact papers; 9th structures congress proceedings; 1991 April 29-May 1; Indianapolis, IN. New York: American Society of Civil Engineers: 482-485.

Taylor, R.J.; Ritter, M.A. 1990. *The development of longer span wood bridges.* In: Bakht, B.; Dorton, R.; Jaeger, L. eds. Developments in short and medium span bridge engineering '90: Proceedings of the 3d international conference on short and medium span bridges; 1990 August 7-10; Tononto, ON, Canada. Montreal, P.Q., Canada: The Canadian Society of Civil Engineering: 391-402. Vol. 2.

Ritter, M.A.; Geske, E.A.; McCutcheon, W.J.; Moody, R.C.; Wacker, J.P.; Mason, L.E. 1991. *Methods for assessing the field performance of stress-laminated timber bridges.* In: Proceedings of the 1991 International Timber Engineering Conference; 1991 September 2-5; London. High Wycombe, United Kingdom: Timber Research and Development Association; 3: 319-326.

A limited number of free copies of most of these publications are available from the Forest Products Laboratory, One Gifford Pinchot Drive, Madison, WI 53705-2398. Requests for the Timber Bridge manual (EM7700-8) are handled by the National Timber Bridge Information Resource Center - see contact address on p. 3.

NDT TESTING - A Review

The USDA Forest Service, Forest Products Laboratory (FPL), and Washington State University (WSU) have been actively developing nondestructive testing (NDT) techniques for wood products for more than 30 years. Their individual and combined efforts of research and technology transfer activities have yielded a variety of NDT tools and techniques that are commonly used by manufacturers and users of forest products throughout the world.

Recently, individuals and organizations have shown considerable interest in the use of NDT for assessing the performance of wood members in structures. Both the FPL and WSU have received numerous requests for background information that illustrates use of NDT techniques for in-place member assessment. Questions are frequently asked about fundamental NDT concepts and about previous NDT research that might be extended to a particular application.

A report was prepared to provide a synthesized information base to aid in addressing such requests. This report is a compilation of various published research and application efforts (through 1989) that have focussed on NDT of wood products.

The report begins by examining fundamental concepts for NDT of wood. It then reviews pertinent laboratory investigations designed to explore fundamental concepts and presents several examples of how to apply these concepts to in-place assessment of wood members. Recommendations are also given for future in-place assessment NDT research.

Reference

Ross, R.J.; Pellerin, R.F. 1991. *Nondestructive testing for assessing wood members in structures: A review.* Gen. Tech. Rep. FPL– GTR– 70. Madison, WI: USDA, Forest Service, Forest Products Laboratory. 27 p.

More Dividends For You

Dividends From Wood Research is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research.

Publications are listed within the following general categories:

- Anatomy and Identification
- Biodeterioration and Protection
- Chemicals From Wood
- Energy
- Engineering Properties and Design Criteria
- Fiber and Particle Products
- Fire Safety
- Microbial and Biochemical Technology
- Mycology
- Processing of Wood Products
- Pulp, Paper, and Packaging
- Timber Requirements and Economics
- Tropical Wood Utilization
- Wood Bonding Systems

To be placed on the *Dividends* mailing list, contact:

Information Services
USDA, Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

Program information available to information providers

Timber Bridge Information Center

Contact the Timber Bridge Information Center, NE Area, State and Private Forestry, USDA, Forest Service, 180 Canfield Street, Morgantown, WV 26505 for the following items.

_____ USDA, Forest Service. *Status Report: The Timber Bridge Initiative: Fiscal Year 1992*

_____ NATaT's Reporter "*Timber bridges help renew rural economies*"

_____ Modern Timber Bridges — A Viable Alternative for Rural America

_____ Transportation Report, Office of Transportation, USDA, Washington, DC. *Rural Bridges: An Assessment Based Upon the National Bridge Inventory.* August, 1989.

_____ USDA, Forest Service. *Timber Bridge Design & Construction Manual.* 1991.

_____ Quarterly Newsletter "Crossings"

_____ ABC Videotape

_____ Timber Bridge Videotape "*A Page From the Past a Bridge to the Future*"

_____ West Virginia University Bridge Plans

_____ Demonstration Bridge Proposal Package

_____ Wood Design Focus newsletter reprints

_____ Publication List

_____ Promotional Booklet

_____ Timber Bridge Model

_____ Brochure: *Award Winning Timber Bridges*

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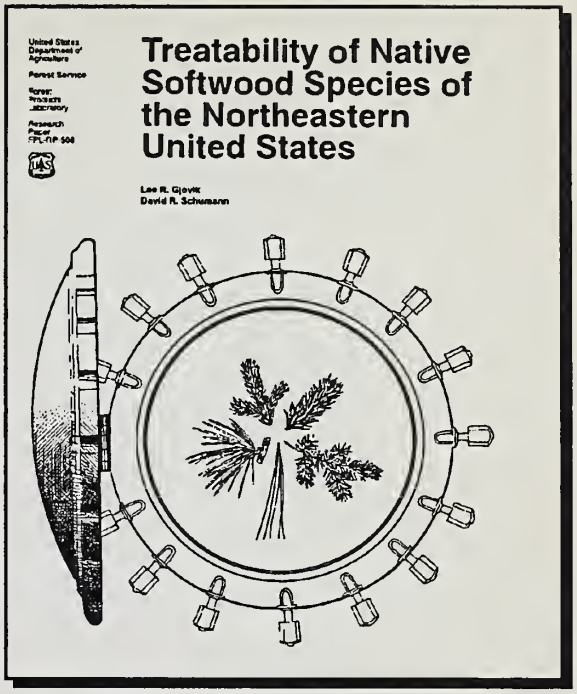
Increasing commercial value by preservative treatment

Treatability of N.E. U.S. Softwoods

Several softwood species of the northeastern United States could have greater commercial value if they could be treated with preservatives. Balsam fir, eastern spruce, and eastern hemlock are candidate species. However, these species are susceptible to spruce budworm attack. In a recent study, FPL scientists explored whether wood from dead (defoliated) or dying (partially defoliated) trees of these species could be treated successfully with ammoniacal copper arsenate (ACA) or chromated copper arsenate (CCA).

For all species, scientists studied the effect of incision on penetration and retention of preservative. Results demonstrate the positive influence of incising to improve preservative penetration of refractory species. Both ACA and CCA penetrated more deeply into incised wood compared to unincised wood under most conditions. Likewise, preservative retentions were significantly greater in incised wood than in unincised wood.

Highly significant incising-preservative interactions for retention occurred in undefoliated eastern larch and eastern hemlock, totally defoliated eastern spruce, and undefoliated and partially defoliated red pine. When the effect of the preservative type was significant, ACA penetrated the wood deeper than did CCA, with the exception of partially defoliated red pine. An anomaly was found with regard to red and white pine. In both species, CCA penetrated better than ACA, which is contrary to general opinion.



Researchers also studied the relationship of treatability to growth rate in three other softwood species (red pine, white pine, and eastern larch), which vary from slow grown (naturally grown) to fast grown (plantation grown). Growth rate had no appreciable, consistent, or significant effect on either preservative retention or penetration in any of the three species tested.

Stake test plots have been established at the Harrison Experimental Forest, Saucier, MS, and in Cumberland Center, ME. In addition, exposure decks have been fabricated at the Harrison Experimental Forest and in Amherst, MA. Both the stakes and deck material have been monitored annually, and the results will be reported in the future.

For further information, contact:

Terry L. Highley, Supervisory Research Plant Pathologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9254

Reference

Gjovik, L.R.; Schumann, D.R. 1992. *Treatability of native softwood species of the northeastern United States.* Res. Pap. FPL-RP-508. Madison, WI: U.S. Dept. of Agric., Forest Service, Forest Products Laboratory. 20 p.

From The Program Leader -

This issue highlights continuing FPL research efforts which support the National Timber Bridge Initiative funded in 1989. Major FPL research studies on transportation structures, including timber bridges, have been on-going prior to this national Initiative.

In recognition of this work, the focus of the Initiative research effort has been centered at the Forest Products Laboratory at Madison, WI. Numerous research projects are conducted with collaborators nationwide. Importantly, the Timber Bridge manual (EM 7700-8) was authored by Mike Ritter, FPL Research Engineer, and serves as a major resource for engineers using wood in the design of transportation structures.

Such information can help resolve massive national transportation problems, particularly the need to address improved local roads and bridges. Wood as a renewable material can often compete favorably with concrete and steel in first and life-cycle costs, particularly for secondary-road bridges and for other transportation structures.

The nationwide Cooperative Extension System information providers can be a vital link in an inter-agency partnership of forest products technology transfer efforts to serve the public. In your state, has local road improvement planning included wood transportation structures under the federal transportation funding (Transportation Funding — Mobility 2000) available to all local governments?

The *Extend* newsletter is designed to inform Extension personnel about current wood products research information and educational materials. Articles present opportunities to strengthen Extension programs for addressing national, state and local needs. Resources do not permit mailings to *county-based* Extension professionals. State Extension program leaders and specialists in Forest Products, Marketing, Housing, Energy, Ag Engineering, and Community Resource Development are urged to share *Extend* information with county-based staff and clientele. Feel free to reproduce and distribute as needed.

Extend is also being sent to State Foresters, state Forest Products Utilization specialists, RC & D specialists, and key Forest Service staff. You and your professional counterparts have an opportunity to develop effective joint state and local wood products programs. The National Wood Products Extension Program has been available to assist you.

The National Wood Products ExtensionProgram (NWPEP) funded in 1988 as a 3-year special project will terminate as of September 30, 1992. We trust our readers and the user public have benefitted by our work and that they will continue to use the valuable resources of the Forest Products Laboratory in the future.

Extend was edited and compiled by Dr. T.A. Peterson, Program Consultant, and produced in-house using the publishing tools available to users of IBM PCs and compatibles. Copy for *Extend* was produced on an IBM-AT (386) PC, using a Viking I Moniterm full-page monitor for page composition. Manuscripts were entered and pages composed in PageMaker 4.0. Camera-ready copy was proofed and prepared on an Apple Laserwriter Plus Postscript printer . The Postscript file can be distributed via E-MAIL as an alternative to mailing printed copies.

F. Robert Mosdal

National Wood Products Extension Program
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398

(608)231-9330
FTS 384-5330
FAX (608)231-9592

EMAIL:
Mosdal@WISPLAN.UWEX.WISC.EDU
Peterson_T@WISPLAN.UWEX.WISC.EDU

Test protocol developed for the engineers

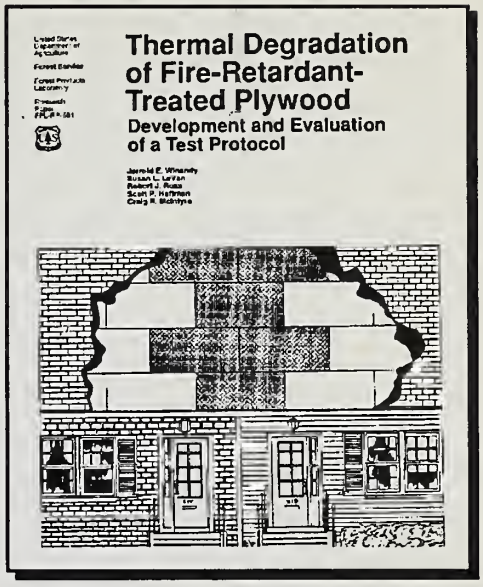
Thermal Degradation of FRT Plywood

For more than 50 years, untreated and fire-retardant-(FR) treated lumber and plywood have been successfully used in structures exposed at or near room temperature. There are no known practical in-service strength reductions in that exposure.

Untreated plywood also has a long record of adequate performance when used as roof sheathing. Since the early 1960's, FR-treated plywood and lumber have been used in the roof structures of commercial buildings on a limited scale. However, about 10 years ago, two major model building codes allowed the use of FR-treated plywood roof sheathing as a replacement for noncombustible deck and parapet-wall systems in some multifamily structures. In addition, at the time the codes were changed, several FR formulators changed their chemical formulation. In the past decade, a number of roof failures have occurred in structures having some type of FR-treated plywood used as roof sheathing.

Roof sheathing is periodically exposed to temperatures as high as 175°F (80°C). Temperature has been shown to be a primary factor in strength loss or in-service strength loss. The FR-treated roof sheathing that undergoes in-service thermal degradation usually exhibits several classic visual characteristics. Degraded plywood roof sheathing darkens in color, exhibits a dry-rotted-like appearance, crumbles easily when abraded, and often exhibits excessive cross-grain checking. However, the sheathing does not necessarily exhibit each of these characteristics.

FPL researchers have developed and evaluated a new test protocol (ASTM 1991) for screening potential fire retardant treatments for plywood that is continuously or periodically exposed to elevated temperatures.



In the protocol, untreated and monoammonium-phosphate-treated Southern Pine plywood specimens were exposed to various exposure temperatures and durations under steady-state environments of 130°F (54°C) –73 percent relative humidity (RH), 150°F (65°C) –76 percent RH, 170°F (77°C) –79 percent RH or 170°F (77°C) –50 percent RH. All specimens were mechanically tested in either bending or tension.

Monoammonium-phosphate-treated plywood had lower bending and tension strength than did untreated plywood at all temperatures. The strength degradation rate of untreated and treated plywood increased as exposure temperature increased and appeared constant for any treatment-temperature combination (that is, linear over time). The strength degradation rate was greater at 170°F (77°C) –79 percent RH than at 170°F (77°C) –50 percent RH for both untreated and treated plywood. Within the RH limits studied, the magnitude of the RH effect did not appear to be as influential as the temperature effect.

The results indicate the protocol provides an effective screening method for comparing the effects of extended exposure to elevated temperature on strength of untreated plywood and plywood treated with commercial fire-retardant formulations.

For additional information, contact:

Jerrold E. Winandy, Research Forest Products Technologist
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231- 9316

Reference

Winandy, J.E.; LeVan, S.L.; Ross, R.J.; Hoffman, S.P.; McIntyre, C.R. 1991. *Thermal degradation of fire-retardant-treated plywood: Development and evaluation of test protocol.* Res. Pap. FPL–RP–501. Madison, WI: U.S.Dept. of Agriculture, Forest Service, Forest Products Laboratory. 21 p.

Review of research pertaining to labor demand

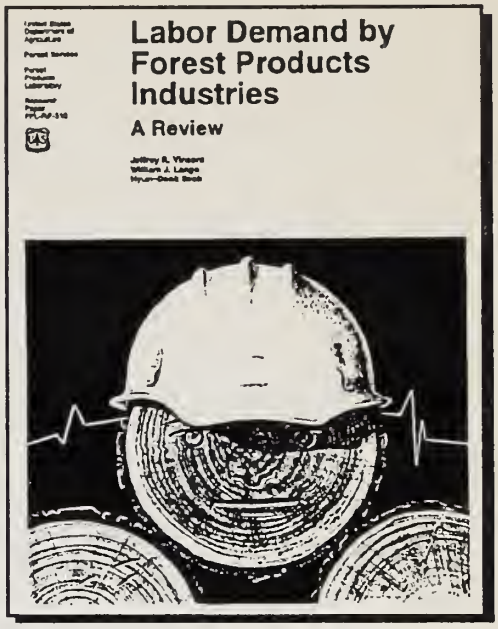
Labor Impact on Forest Products Industries

Changes in employment and income have been key issues in many policy debates related to North American forest products industries. Anticipated threats to processing jobs helped galvanize political support for trade sanctions against Canada in the 1986 softwood lumber dispute.

The possiblilty of chronic unemployment in timber-dependent communities underlies much of the controversy over the fate of old-growth forests and the spotted owl in national forests in Washington and Oregon. Similar concerns have led to proposals to ban log exports from state forests in the Pacific Northwest.

Market models of the North American forest products sector are, by construction, more suited to analyzing wood supply and demand than labor-related issues. Labor impacts are most commonly analyzed by input-output models. Such models do not take into account such economic variables as wage rates, scale of production, and technical change.

Econometric research during the past 20 to 30 years has indicated that factors other than output are indeed significant determinants of input demand by forest products industries. FPL researchers extracted and summarized findings from this substantial literature that pertain to labor demand. Although very few of the studies were explicitly concerned with labor demand, together they contained a substantial amount of useful information.



A recent research report reviews major microeconomic relationships (elasticities), describes principal empirical approaches used to estimate elasticities, and summarizes statistical estimates drawn from the literature.

The report also discusses implications for policy analysis and suggests future research directions. For example, derived estimates provide overwhelming evidence that long-run labor demand is not characterized by simple input-output econometric models.

Although research to date provides a consistent and enlightening picture of labor demand by forest products industries, our understanding remains rudimentary. However, enough information on aggregate, long-run labor demand has been developed to create theoretically sound and empirically reliable models of labor demand for use in forest sector models.

Further research will be required to develop labor demand and labor supply equations, so that both labor input and its wage are determined during forest sector model solution.

For additional information, contact:

William J. Lange, Supervisory, Research Forester
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705-2398
(608)231-9362

Reference

Vincent, J.R.; Lange, W.J.; Seok, H. 1992. *Labor demand by forest products industries: A review.* Res. Pap. FPL–RP510. Madison, WI: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory. 13 p.

Postscript

This will be the *last* issue of the *Extend* newsletter. Recent independent efforts to obtain continuation funding from Congress through the FY93 Appropriations Bill failed and our program will end September 30, 1992.

The National Wood Products Extension Program (NWPEP) has been funded as a special project by the Federal Extension Service through a cooperative agreement with the University of Wisconsin Cooperative Extension Service and with support from the US–Forest Service, Forest Products Laboratory, Madison.

The major NWPEP program objective was to facilitate the transfer of wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers by using the nationwide Cooperative Extension System (CES). We have tried to assist our CES peers in various ways to accomplish this objective now and in the future.

NWPEP staff acknowledge with thanks the opportunity to pilot the special project for the past 4 years through the cooperative agreement with the Federal Extension Service and UW-Extension. We pay special tribute to the strong support of the Forest Service, Forest Products Laboratory over the past 8 years, as this interagency program evolved. This unique partnership, indeed, is a prudent and cost-effective coalition to facilitate forest products technology transfer. We predict it will be reconstituted in the future by decision-makers who clearly understand the role such a partnership serves in meeting national needs.

The NWPEP staff (2) strongly advocated the use of emerging electronic communication technologies for and by Cooperative Extension Service professionals. In support of Extension information providers and their peers, we were early developers of full-text retrieval computer products, the in-house development of CD-ROM discs, and the initial proponent of a Forest Products Information node at FPL to be accessible on the nationwide Internet communication network. Unfortunately, the full implementation and support of these visionary activities will be delayed at best as NWPEP ends.

NWPEP, with a proud record of vision and accomplishment, can be viewed as an important chapter in the history of CES. More than a completed pilot program, however, NWPEP provides a significant example of warranted interagency partnerships that work and are needed to more fully address the needs of our nation.

National Wood Products Extension Program
Forest Products Laboratory
1 Gifford Pinchot Drive
Madison, WI 53705-2398

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Appendix 5.

3-year Program Proposal

3-year Funding Proposal To

ES-USDA

From

University of Wisconsin

Cooperative Extension Service

For

National Wood Products Extension Program

In Cooperation With The

Forest Service - USDA

Forest Products Laboratory - Madison

March 21, 1988

EXECUTIVE SUMMARY

This proposal seeks 3-year funding from the ES-USDA, at $80,000 per year, together with $14,343 from UW-Extension and $10,000 in other support from FS-FPL, to continue and expand the National Wood Products Extension Program (NWPEP) on a cooperative interagency basis.

The objective is to build teamwork between wood products research, other agency technology transfer efforts, and the Cooperative Extension System - federal, regional, state, county - to accelerate the transfer of wood products technology. NWPEP would augment on-going Extension programs and initiatives not only in wood products but housing, energy, natural resources, ag engineering, marketing, community resource development, and youth development, through translating and disseminating research information, developing model programs, building information networks, serving as liaison to researchers, and providing overall coordination for wood products technology transfer efforts.

Wood is a traditional and widely-used material, but technical knowledge about wood is not widespread. Only a few colleges and universities teach wood technology, and most engineers and architects do not know enough about wood as a material to properly use it. Builders use wood in traditional ways, and building codes are slow to include new design/construction methods and materials. Producers of wood products, sellers, and users would all benefit if they had more technical information about wood, wood products, and wood processing.

The University of Wisconsin Cooperative Extension Service (UW-CES) and the Extension Service-USDA (ES-USDA) have three years experience working closely with the Nation's foremost wood research laboratory to extend research information to Extension audiences. This cooperative program at the U.S. Forest Service Forest Products Laboratory in Madison (FPL) produced impressive results despite year-to-year funding, which precluded long-term planning. Now a number of recent decisions are merging, creating an unprecedented opportunity to greatly improve wood products technology transfer. These actions are referenced in the "Situation" section of this proposal.

A brief review of events leading to the present status of the Extension project follows:

August 1981: Gale VandeBerg, former Director of Extension and Chair of ECOP, urged Mary Nell Greenwood, former Administrator of ES-USDA, to initiate a discussion with Max Peterson, former Chief of the Forest Service (FS), on how ES and FS could establish a full-time wood products extension specialist position at FPL. Director VandeBerg and former FPL Director Robert Youngs envisioned the benefits of such cooperation.

October 1983: ES-USDA funding support for the Extension position was announced at the annual Forest Products Research Conference (FS-FPL) in Madison by Administrator Mary Nell Greenwood. The position was established, based on yearly funding, through a cooperative agreement with the UW-CES, ES-USDA, and FS-FPL. Don Stumbo, on leave from his Extension position in Tennessee, served as project leader the first year.

May 1985: The project was funded for a second year, during which Ted Peterson and Lew Hendricks (Extension Forester, Wisconsin and Wood Products Extension specialist, Minnesota) shared program leadership.

May 1986: The program was funded again for a third year under the leadership of Ted Peterson. The project is presently continuing with carryover funds through February 1988.

April 1987: Upon the request of ES-USDA Administrator Myron Johnsrud, the project was evaluated during the third year by an interagency team consisting of the Southern Regional Extension Forester, and staff from the Forest Service, ES-USDA, and the University of Wisconsin. The evaluation team presented four alternative funding proposals and highly recommended two to the Administrator. *Alternative 1.* called for a permanently funded program for greater continuity and which would enable long-term planning and programming. *Alternative 2.* involved 3-year funding to achieve a greater degree of program continuity and effectiveness.

January 1988: ES-USDA Administrator Myron Johnsrud pledged funding support for a three year period, subject to submission by UW-CES of a satisfactory project proposal.

Implementation of this proposal will capitalize on the new opportunities presented to the project cooperators:

- the Cooperative Extension System National Initiatives

- the Forest Service dedicated emphasis on Technology Transfer

- other opportunities referenced in the Situation statement.

We believe that this project can have an even greater positive impact than in the past, given the assurance of 3-year funding by ES-USDA, and the serious commitment by the Forest Service of cooperation, support services and funding. We are pleased that the Extension System has been identified as a partner in the FS-FPL overall Technology Transfer plan, as well as in individual technology transfer plans, such as Timber Bridges and IMPROVE. We envision strong teams of Extension, Forest Service, and State Forester's utilization and marketing professionals working together to achieve more rapid and widespread technology transfer than previously possible.

We submit this proposal with the view that the project will also strengthen the Cooperative Extension System National Initiatives by bringing wood research information from the Forest Products Laboratory, and other federal, university and private laboratories, to industry users and public consumers. Through these efforts our Nation can more fully capitalize on the benefits of this valuable renewable resource - WOOD.

SITUATION

There could hardly be a more favorable set of circumstances favoring the funding of this proposal. Consider the following major current initiatives, by Extension and others, that call for strong, collaborative, interagency wood products programs:

A. Cooperative Extension System National Initiatives

Wood products have a major role to play in "Conservation and Management of Natural Resources", "Revitalizing Rural America", and "Competitiveness and Profitability of American Agriculture". Wood products can also contribute to "Alternative Agricultural Opportunities", "Family and Economic Well-Being", and "Building Human Capital".

B. Federal Technology Transfer Acts of 1980 and 1986

In response to these acts calling for Federal research agencies to provide for more adequate technology transfer, Forest Service - Research, and Forest Service - State and Private Forestry (S&PF) have implemented a major technology transfer plan which recognizes a strong role for Extension. Recent actions highlight this commitment:

1. Interagency evaluation (April 21-22, 1987) of the National Wood Products Extension Program at the Forest Products Laboratory (FPL). The review team recommended continuation of the program with provision for greater continuity through long-term funding.

2. Combined Program Review of the Forest Products Laboratory (June 1-5, 1987). Issue 2, Technology Transfer, Finding 7 of the review report called for an expanded involvement by S&PF and Extension at the FPL.

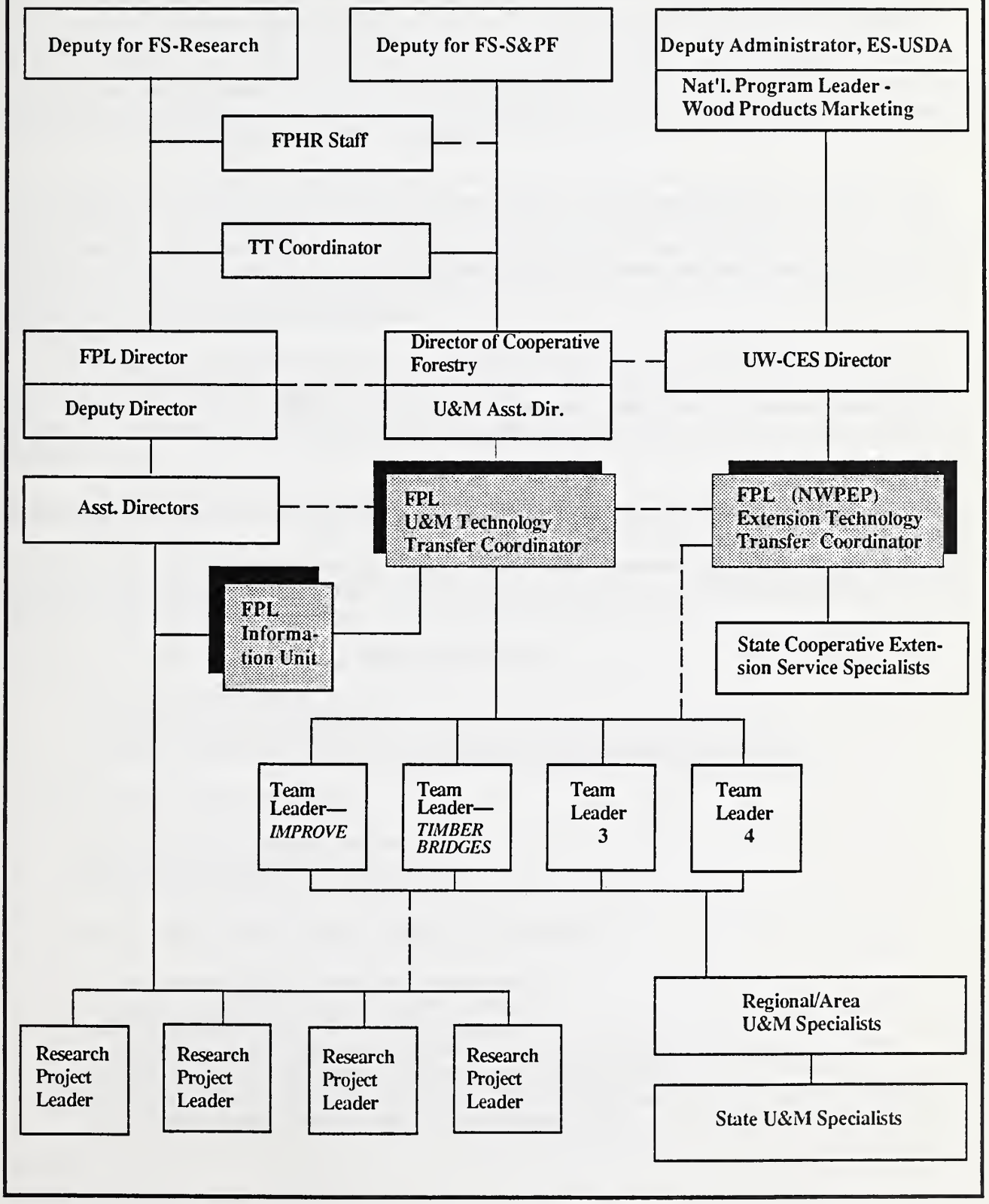
3. Approval (January 12, 1988) by Forest Service Deputies Ohman (Research) and West (S&PF) of an Action Plan to Improve Technology Transfer at FPL by creating a new S&PF position to be located at FPL. This S&PF Technology Transfer Coordinator will be a parallel position to the Extension Technology Transfer position at FPL in an organizational structure for technology transfer which includes Forest Service Research, Forest Service S&PF, and the Cooperative Extension System. Interagency teams will address specific issues, and state and regional specialists in S&PF, State Forestry, and State Cooperative Extension Services will perform their traditional roles of service and education.

The new position of Technology Transfer Coordinator at FPL will report to the Cooperative Forestry Staff in the office of the Forest Service Chief. The Coordinator will work closely with FPL management, S&PF field units, National Forest System, academia, industry and the staff of the Deputy Chief - State & Private Forestry as needed to direct technology transfer actions.

Ad hoc interdisciplinary team members will be designated by the coordinator for high priority research projects based on the need for particular expertise and coordination. Team members may be selected from any Deputy area or Extension Service for the duration of the planned activity. Assignments may range from a detail of 3 to 6 months on a part-time basis for small projects, to full-time 3 to 5 year assignments for long term programs. Team leaders will return to their previous positions when each assignment is completed. They may or may not be located at FPL, depending on the needs of the project.

The following chart illustrates the proposed organization:

Technology Transfer Organization
FS-Forest Products Laboratory, Madison



C. The Importance to the Nation of its Prime Renewable Raw Material - WOOD.

Wood is a major component of the U.S. economy. It is a major renewable resource. The total wood industry represents 7 to 10% of the total national industrial employment, payroll, value added, and capital expenditures in plant and equipment, not counting a large share of construction and sales. Much of this economic activity is located in rural America, and all of it impacts the tree-growing areas of rural America. Scientific knowledge about wood and wood products is not widespread. In the entire nation there are less than 400 professionals who belong to the Society of Wood Science and Technology (SWST) and most of these are teachers or researchers. Only half a dozen land-grant universities have sufficient resources in their teaching and research programs to consistently provide inputs to wood products Extension programs. Without access to Federal wood products research, there can be little progress in the wood industry. It is significant that Forest Service - Research is committed to involving the Cooperative Extension System in national cooperative technology transfer efforts.

The importance of wood as a renewable, energy-efficient raw material continues to increase in the U.S. and abroad. Lags in the adoption of new wood products technologies, however, seriously influence the effective use of wood. Because available forest products research information is not fully utilized or adopted in a timely manner, wood is less competitive than it should be. Significant opportunities exist to improve the productivity of the woodusing industry and the performance of the consuming public in the use of wood. This can be accomplished through a more effective linkage among the Forest Service, universities, industry and the Cooperative Extension System to disseminate wood products research information.

The report of the New Farm and Forest Products Task Force to the Secretary of Agriculture recognizes a significant, unrealized economic potential in forest products for helping achieve diversification and rural development. One of the strategies recommended by the Task Force (Summary, page 2) is:"...4. Establish mechanisms to facilitate agricultural (and forest products) technology transfer, particularly between the public research and private industrial sectors."

D. Extension Evaluation Studies Pointing Out the Weak Link to Research

Six formal evaluation studies which Claude Bennett (ES-USDA) synthesized (unpublished) focused primarily on the application of agricultural research, but many of the generalizations appear to be equally applicable to wood products. To strengthen technology transfer:

1. Improve communications between Extension and Research

    a. Assign liaisons to research units
    b. Sponsor information-sharing conferences involvingExtension, research, and users
    c. Develop communication networks for targeting technology development and utilization

2. Improve Extension staff credentials

    a. Recruit able scientists into Extension
    b. Train Extension agents in new technologies
    c. Specialize to permit in-depth knowledge

3. Use joint planning and coordination of Extension and Research

    a. Joint long-range planning with research organization
    b. Target research and development to user's needs
    c. Use researchers to deliver the information to the user
    d. Establish national or regional research and extension centers to focus on priority problems
    e. Have researcher translate findings into technology needed by users
    f. Use extension-researcher teams to develop state-of-the-art educational materials in a priority subject
    g. Use extension-researcher committees to identify research needs

4. Use joint appointments and common location

   a. Use joint appointments between research and Extension
   b. House Extension and researchers together

5. Allow extension staff to conduct research or testing

   a. Test and adapt technology to the situations
   b. Use local tests to prove technology, as well as demonstrate it (as well as convince technology transfer specialists that it really works)

Note especially the need for a strong link between Extension and Research, as in 1a, 1c, 2b, 3a, 3b, 3c, 3d, 3f, and 4b. The Wisconsin project has and will do much to develop this Extension-Research linkage for wood products.

E. Three Years of Cooperation with FPL in Transferring Technology

Recent experience through the pilot National Wood Products Extension Program has demonstrated that the nationwide Cooperative Extension System educational network can be used to quickly channel wood products research information to local users and target priority educational efforts. Through the project newsletter EXTEND, new research information is quickly and effectively disseminated to over 500 professionals. For example, state Extension Ag Engineers receive research findings of more effective designs for structural products and improved wood finishing and adhesive systems. They in turn incorporate these findings into engineering plans and publications. Extension and agency forest products utilization specialists use the research information reported in EXTEND in their state newsletters. Extension Housing specialists use the information in agent training sessions and program materials.

Educational efforts in the Midwest and Southeast have focused on the promotion of the Saw-Dry-Rip (SDR) process for producing dimension lumber from underutilized hardwoods. An example of international scope and importance involves the use of an accepted color test procedure developed by FPL researchers for differentiating white oak from red oak. This test now facilitates export trade with European Economic Community(EEC) countries without costly fumigation requirements. The National Wood Products Extension Program also provided timely updates on revised federal regulations, such as the recent action by EPA affecting the wood treating industry where restricted-use wood preservatives are used. In addition, the National Wood Products Extension Program coordinated the search for available state pesticide resource materials to train wood preservers prior to mandated state certification.

F. Major Functions of NWPEP Program Leader

Leadership functions of the NWPEP program leader will include the following:

1. Serve as coordinator for Extension wood products technology transfer efforts

2. Publish newsletter and disseminate wood products research information using other appropriate means

3. Serve as liaison to researchers

4. Develop model programs

5. Build wood information networks

G. Projected Extension Program Involvement

Extension involvement in coordinated wood products technology transfer efforts will include:

1. Wooden Bridges for Rural America

Extension will play a significant role in the Forest Service national technology transfer plan to improve the local transportation infrastructure by using cost-effective wood materials in bridge replacement and maintenance. Properly designed and constructed wooden bridges can provide a low-cost alternative to steel and concrete. Local wood materials and construction/maintenance crews can be used, reducing community costs for roads. In areas using de-icing salts, wooden bridges have a longer service-life than metal bridges.

2. New Housing Systems

Extension will perform a dominant role in the transfer of new technology and research information on innovative housing systems. The truss-frame system, for example, uses less wood, small dimension lumber (the entire cross-section is one truss, with roof, floor and side walls all of 2 x 4's, precluding the need for 2 x 6's, 2 x 8's, 2 x 10's, etc.), can reduce housing costs, conserve the timber resource, and utilize smaller trees.

Research information on the construction and maintenance of quality interior and exterior environments of wood-based homes, in an era of energy- and cost-efficiency, will continue to be important in educational programming with Extension clientele.

3. System Six

This is a method for producing high-quality, standard sized wood panels for furniture parts from low-quality, small diameter hardwood logs. Extension has an important role to play in transferring this research technology to the wood industry for developing new domestic and foreign markets.

4. IMPROVE

This is a family of utilization and marketing initiatives that offers Integrated Mill Production and Recovery Options for Value and Efficiency. The system is currently made up of eight major programs to be used for evaluating various processes in the primary manufacture of either lumber or veneer. Extension will play a major role in training professionals and wood industry personnel to apply these programs and improve the competitiveness and productivity of woodusing operations.

MISSION STATEMENT

. . . . to transfer to Extension professionals and clientele wood products technology developed at the Forest Products Laboratory (FPL), Forest Service regional wood products research facilities, universities, and other research centers, using the nationwide Cooperative Extension System. Through its National Initiatives, Extension can strongly augment the important national wood products technology transfer efforts of the Forest Service.

LINKING WOOD PRODUCTS TO NATIONAL INITIATIVES

The *National Initiatives* are listed below alphabetically and are referenced by number in the following matrix. Efforts will be concentrated on some initiatives more than others, as indicated by the asterisks.

1. **Alternative Agricultural Opportunities**
2. **Building Human Capital**
3. **Competitiveness and Profitability of American Agriculture**
4. **Conservation and Management of Natural Resources**
5. **Family and Economic Well-Being**
6. **Improving Nutrition, Diet, and Health**
7. **Revitalizing Rural America**
8. **Water Quality**

The National Wood Products Extension Program will utilize the strong Extension linkages with public and private groups to identify ways in which wood products technology can address critical issues within the National Initiatives. The *linkers* include those listed in the following matrix.

Planned National Wood Products Extension Program *actions* to transfer wood products technology are noted. Other actions and linkages will be developed as cooperative program plans are implemented during the next three years.

National Wood Products Extension Program Links Wood Products to ES/CES National Initiatives

Linkers	Actions	Initiatives							
		1	2	3	4	5	6	7	8
State Extension Specialists (CES)									
Wood Products	*Extend*, publications, A-V, Computer BB, Training, IMPROVE TT Plan, Timber Bridge TT Plan, Wood Preservation TT Plan	*	*	*	**			**	*
Natural Resources	*Extend*, publications, A-V, Computer BB, Training, TT Plans	*	*	*	**			**	*
Community Resource Development	*Extend*, publications, A-V, Computer BB, Training, Timber Bridge TT Plan	*		*	*			**	
Housing	*Extend*, publications, A-V, Computer BB, Training					**	**	**	
Energy	*Extend*, publications, A-V, Computer BB, Training	*		*	*	*		*	
Transportation	*Extend*, publications, A-V, Computer BB, Training, Timber Bridge TT Plan	*		*	**			**	
Marketing	*Extend*, publications, A-V, Computer BB, Training	*		*	**	*		**	
Ag Engineering	*Extend*, publications, A-V, Computer BB, Training, Timber Bridge TT Plan, Wood Preservation TT Plan	*		*	*	**	*	*	*
4-H	*Extend*, publications, A-V		*		*	*		*	
Regional Extension Forester(s)	*Extend*, publications, A-V, Computer BB, all TT plans	*		*	**	*	*	**	*
County Extension Staff (CES)	*Extend*, publications, A-V, Rural Information Center, wood use consultations	*	*	*	*	*	*	**	*

National Wood Products Extension Program Links Wood Products to ES/CES National Initiatives

Linkers	Actions	Initiatives							
		1	2	3	4	5	6	7	8
University									
University Extension (non-CES)	*Extend,* publications, A-V, Training, state TT agent, joint programming	*		*	*	*	*	*	
Wood Products Teaching	*Extend,* publications, A-V, Training, state TT agent	*		*	*			*	
Wood Products Research	*Extend,* publications, A-V, Computer BB, Training, research	*		*	*	*	*	**	
Forest Service (FS)									
Research, FPL	*Extend,* research feedback, TT coordinator, TT agent	*		*	*	*	*	*	*
Research, other FS	*Extend,* research feedback, TT agent	*		*	*			*	*
State & Private Forestry (S&PF)	*Extend,* publications, A-V, Computer BB, Training, all TT plans, TT coordination	*		*	*	*		**	
National Forest System	*Extend,* publications, A-V			*	*			**	
State Forestry Organizations									
State Forester	*Extend,* all TT plans	*		*	*			**	*
Forestry Specialists	Publications	*		*	*			**	
Utilization & Marketing Specialists	*Extend,* publications, A-V, Training, all TT plans	*		*	*			**	*

National Wood Products Extension Program Links Wood Products to ES/CES National Initiatives

Linkers	Actions	Initiatives							
		1	2	3	4	5	6	7	8
Other USDA Agencies									
Foreign Agricultural Service (FAS)	*Extend,* consultations			*				*	
FmHA	*Extend,* publications	*		*		*		*	
National Agricultural Library (NAL)	*Extend,* Rural Information Center wood information	*		*	*	*		*	
Agricultural Research Service (ARS)	*Extend,* information retrieval	*		*	*			*	
CSRS	*Extend,* A-V, information retrieval	*		*	*			*	
Office of Transportation (OT)	*Extend,* Timber Bridge TT plan				*			*	
Other Federal/State Agencies									
EPA	Publications				*	*	*	*	*
HUD	Publications				*			*	
Commerce	Publications			*				*	
TVA	*Extend,* publications, A-V, some TT plans			*	*			*	
State Economic Development Agencies	Publications, consultations	*		*	*			*	
State Agricultural Departments	Publications, consultations	*		*	*	*	*	*	
State Highway Departments	Publications, Timber Bridge TT plan, consultations				*			*	

National Wood Products Extension Program Links Wood Products to ES/CES National Initiatives

Linkers	Actions	Initiatives							
		1	2	3	4	5	6	7	8
Professional Associations									
Society of Wood Science & Technology	Training	*		*	*		*	*	
Forest Products Research Society	*Extend,* Training	*		*	*		*	*	
American Society of Ag Engineers	Training	*		*	*	*	*	*	*
Industry Associations									
National Forest Products Association	*Extend,* publications, A-V			*	*	*	*	*	*
Western Wood Products	*Extend,* publications, A-V			*	*	*	*	*	
National Hardwood Lumber Association	*Extend,* publications, A-V, Training			*	*			*	
Southern Forest Products Association	*Extend,* publications, A-V			*	*			*	
State & Regional Associations	*Extend,* publications, A-V			*	*			*	
National Home Builders Association	*Extend.* publications, A-V					*	*		
Builders/Contractors/Architects	Publications					*	*		
Wholesale/Retail Building Materials Dealers	Publications					*	*		
General Public	Publications, consultations, mass-media	*		*	*	*	*	*	*

NATIONAL WOOD PRODUCTS EXTENSION PROGRAM

PROPOSED ANNUAL BUDGET (THREE YEARS)

	ES-USDA	UW-CES	FPL-FS
SALARIES			
PROGRAM COORDINATOR(*)	$ 28,658	$ 11,383	$ ------
FRINGES (26%)	7,451	2,960	------
SUBTOTALS	*36,109*	*14,343*	------
SERVICES & SUPPLIES			
AD HOC SPECIALISTS	10,000	------	------
MEDIA & PUBLICATIONS	15,891	------	10,000
TRAINING & SUPPORT	2,500	------	------
SUPPLIES & TRAVEL	7,500	(**)	(**)
SUBTOTALS	*35,891*	------	*10,000*
CAPITAL	*8,000*	------	------
TOTALS	*$ 80,000*	*$ 14,343*	*$ 10,000*

(*) $51,000 PROGRAM COORDINATOR SALARY

UW-CES SALARY CONTRIBUTION IN COOPERATIVE AGREEMENT BASED ON A 75% NATIONAL PROJECT COMMITMENT OF PROGRAM COORDINATOR, AN ANNUAL SALARY/FRINGES AMOUNT OF $14,343 AND IN-KIND SUPPORT SERVICES

(**) FPL PROVIDES OFFICE, PHONE, SECRETARIAL SUPPORT, DG USE, AND OTHER SUPPORT SERVICES

UW PROVIDES OFFICE, PHONE, SECRETARIAL AND OTHER SUPPORT SERVICES

NWPEP

National Wood Products
Extension Program

Appendix 6.

Cooperative Agreement —
ES-USDA, UW-EX, FS-USDA – FPL

United States Department of Agriculture | Extension Service | Office of the Administrator | Washington, D.C. 20250

DEC 22 1988

JAN 3 1989

Dr. Patrick G. Boyle
Director
Cooperative Extension Service
University of Wisconsin
432 N. Lake Street
Room 527
Madison, Wisconsin 53706

Dear Pat:

This is to confirm that the Cooperative Agreement covering the project entitled, "National Wood Products Extension Program," should be changed to reflect the number 89-EXCA-2-0883 and an effective date of October 1, 1988 through September 30, 1989. All other aspects of the Cooperative Agreement should remain as stipulated.

The $80,000 approved for this project is being included in your January 3, 1989, Letter of Credit.

Sincerely,

MYRON D. JOHNSRUD
Administrator

United States Department of Agriculture | Extension Service | Office of the Administrator | Washington, D.C. 20250

Dr. Patrick G. Boyle
Director
Cooperative Extension Service
University of Wisconsin
432 N. Lake Street
Room 527
Madison, Wisconsin 53706

Dear Pat:

This is to confirm our approval of the special project entitled, "National Wood Products Extension Program." The amount of funds approved for fiscal year 1988 is $80,000.

Enclosed are four copies of Cooperative Agreement No. 88-EXCA-2-0883 between the Cooperative Extension Service, University of Wisconsin, and the Extension Service, U.S. Department of Agriculture (ES-USDA). If the Agreement meets with your approval, please sign and return two copies to this office. We propose to fund this project for two additional years subject to satisfactory progress of the project and the availability of funds.

Financing of this project will be by Letter of Credit in the same manner as all other ES-USDA funds. Upon receipt of the signed Agreement, the next Amendment to the Letter of Credit will include the $80,000.

Donald E. Nelson, of our staff, will represent Extension Service on this project.

Sincerely,

MYRON D. JOHNSRUD
Administrator

Enclosures

No. 88-EXCA-2-0883

COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

I. Purpose

The purpose of this project is to disseminate wood products technology to the general public and to the wood products industry utilizing the Cooperative Extension System.

II. Situation

In 1986, the Cooperative Extension System embarked on a new and exciting venture that focuses on issues critical to the economic, social, and environmental progress of Americans. Through identification of National Priority Initiatives, Cooperative Extension signaled a change in direction and creation of a new agenda to address the future. Wood products technology can play a vital role in at least six of the new initiatives.

Wood is a major renewable resource of the U.S. economy. The total wood industry represents 7 to 10 percent of the total national industrial employment, payroll, value added, and capital expenditures in plant and equipment, not counting a large share of construction and sales. Much of this economic activity is located in rural America and all of it impacts the tree-growing areas of rural America. Wood is a traditional and widely-used material, but technical knowledge about wood is not widespread. Most engineers and architects do not know enough about wood as a material to properly use it. Builders use wood in traditional ways and building codes are slow to include new design/construction methods and materials. Producers of wood products, sellers, and users would all benefit if they had more technical information about wood. Without access to Federal research on wood products, there can be little progress in the wood industry.

Recent experience through the pilot National Wood Products Extension Project (NWPEP) has demonstrated that the nationwide Cooperative Extension System educational network can be used to quickly channel wood products research information to local users and target priority educational efforts. Through the project newsletter EXTEND, new research information is quickly and effectively disseminated to over 500 professionals. For example, Extension Ag Engineers receive research findings of more effective designs for structural products and improved wood finishing and adhesive systems. They in turn

incorporate these findings into engineering plans and publications. Extension and agency forest products utilization specialists use the research information reported in EXTEND in their State newsletters. Extension Housing Specialists use the information in agent training sessions and program materials.

III. Agreement

It is agreed that the Cooperative Extension Service, University of Wisconsin (CES-UW), and the Extension Service, U.S. Department of Agriculture (ES-USDA), will cooperate for their mutual benefit in the implementation of a comprehensive network for disseminating wood products technology to the public consumers and the wood products industry.

IV. Responsibilities of the Parties

A. The Cooperative Extension Service, University of Wisconsin agrees to:

1. Arrange for approximately 0.75 FTE of experienced Extension staff to serve as project leader to this project and serve the interagency FPL Technology Transfer organization as NWPEP Extension Technology Transfer Coordinator, a parallel position to the S+PF U&M Technology Transfer Coordinator and to the FPL research unit.

2. Provide no less than $14,343 per year direct support to the project each year of the three year Federal funding.

3. Continue and expand the CES wood products technology transfer network through newsletters, consultation, advisories, agent training, networking, electronic technology, and interagency cooperation.

4. Provide leadership or assistance to ES-USDA's NPL for Wood Products Marketing to those national program functions that are most appropriate for the NWPEP project, including:

a) Leadership to continue the publication of a regular newsletter "Extend," broadening the coverage to include other research in addition to FPL, and expand the mailing list.

b) Leadership to expand the NWPEP Bulletin Board, and encourage CES specialists to use it.

c) Leadership to develop training packages or modules for CES staff (except for forestry and wood products specialists) and other agency cooperators. Leadership to apply innovative teaching methods and media to reach these audiences.

d) Supervise staff assigned to the project.

e) Liaison between FPL and the Rural Information Center relative to technical questions pertaining to wood.

f) Liaison between NWPEP and CES-UW for purposes of developing and testing educational methods and materials.

g) Assist NPL in training wood products extension specialists and forestry specialists, including developing national workshops.

h) Assist NPL in representing ES in FS technology transfer planning for timber bridges, IMPROVE, wood preservation, and other technology transfer plans to be identified.

i) Assist NPL in strengthening the 4-H wood science project by developing additional program materials based on research.

j) Assist NPL in Extension/research liaison.

k) Assist NPL to identify need for supporting expertise and arrange for ad hoc specialists to develop specific project materials.

l) Assist NPL in program evaluation of NWPEP.

m) Assist NPL in building liaison with regional Extension entities — Ag engineering centers, regional computer centers, regional rural development centers, regional foresters, etc.

5. Make available the statewide Wisconsin Extension organization to assist in developing, testing, and evaluating opportunities for expanding extension programming in wood products.

6. Consult an interagency, interdisciplinary, technical advisory group for inputs and recommendations relative to the project.

7. Involve other State Extension Services as appropriate in meeting the objectives of this Agreement.

8. Submit quarterly progress reports to the ES-USDA liaison officer.

9. Impose no overhead or indirect cost rate. Any and all overhead will be considered the contribution of the CES-University of Wisconsin.

10. Provide ES-USDA with copies of materials developed as a result of this Agreement.

B. The ES-USDA agrees to:

1. Authorize funds in the amount of $80,000 in the next Amendment to the Letter of Credit. The total cost to ES-USDA under this Agreement will not exceed $80,000.

2. Assign a national program leader with expertise in the area of Wood Products Marketing who will coordinate and monitor the project, make recommendations concerning planning and procedures to be followed, and reporting to ensure that objectives are being fulfilled and are of a national scope, if applicable.

3. Serve as a link between the National Wood Products Extension Program and national agencies, organizations, and associations having an interest in such program.

4. Provide guidance in the evaluation process and other technical assistance as needed.

C. It is mutually agreed that:

1. This Agreement shall become effective on the date of the last affixed signature and shall remain in effect until September 30, 1989, unless extended by mutual consent.

2. This Agreement may be terminated at any time by either party upon receipt of written notice 30 days in advance of the intended date of termination.

3. Should there be unobligated funds remaining at the conclusion of the project, such funds shall be refunded to the ES-USDA and any undrawn authorization under the Letter of Credit revoked.

4. Provisions of the approved proposal on which this Agreement is based that may not be explicitly stated herein are considered an integral part of this Agreement.

5. The cooperation between ES-USDA and CES-University of Wisconsin will be acknowledged on any materials published as a result of work carried out under the terms of this Agreement.

6. Attached hereto and made a part of this Agreement are the provisions of Executive Order No. 11246, dated September 24, 1965, Sec. 202, para. (1) through (7). As appearing throughout these paragraphs, the word "contract" shall be construed to mean "agreement" and the word "contractor" shall be construed to mean CES-University of Wisconsin.

7. No member of or delegate to Congress shall be admitted to any share or part of this Agreement, or to any benefit that may

arise thereafrom; but this provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

8. As a condition of this Cooperative Agreement, the recipient assures and certifies that it is in compliance with and will comply in the course of the Agreement with all applicable laws, regulations, Executive Orders and other generally applicable requirements, including those set out in 7 CFR 3015.205(b), which hereby are incorporated in this Agreement by reference, and such other statutory provisions as are specifically set forth herein.

IN WITNESS WHEREOF, the parties whose signature appear below admit it to having authority to enter into such agreements and agree that this Agreement shall become effective on the date of the last affixed signature.

MYRON D. JOHNSRUD
Administrator

9/12/88
Date

Director, Cooperative Extension Service
University of Wisconsin

9-19-88
Date

No. 89-EXCA-2-0883

AMENDMENT NO. 1
to the
COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Section IV, B-1 is amended as follows:

To authorize additional funds in the amount of $80,000 in the next Amendment to the Letter of Credit. Including the $80,000 previously authorized, the total cost to ES-USDA under this Agreement will not exceed $160,000.

Section IV, C is amended as follows:

1. It is mutually agreed to extend the provisions of the Agreement for the period October 1, 1989 through September 30, 1991.

Add the following:

3. Funds must be drawn on an as needed basis only.

9. No part of the approved Federal funds will be utilized for tuition remission of the participating parties or for the travel of Federal employees of ES-USDA.

10. As a requirement of Section 319 of the Interior Appropriations Act (Public Law 101-121), the recipient (and any subtier recipient), is prohibited from making any payments from Federal funds for lobbying Congress or any Federal agency in connection with the award of a particular contract, grant, cooperative agreement, or loan. A certification must be executed before an award action is made which exceeds $100,000. If any lobbying activity from non-appropriated funds occurs and the application or award action exceeds $100,000, then the recipient (and any subtier recipient if applicable) must disclose to whom payments were made, how much money was involved and the type of work involved. Primary recipients are required to collect the disclosure forms from their subtier recipients and submit them to ES-USDA. Forms are enclosed for your use in meeting this requirement. It is necessary that you complete and return the certification form and the SF-LLL (when applicable) before funds are made available.

No. 89-EXCA-2-0883

AMENDMENT NO. 2
to the
COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Section IV, B-1 is amended as follows:

To provide additional funds in the amount of $80,000 in the next funding authorization under the Payment Management System. Including the $160,000 previously authorized, the total cost to ES-USDA under this Agreement will not exceed $240,000.

Section IV, C is amended as follows:

1. It is mutually agreed to extend the provisions of the Agreement for the period October 1, 1991 through December 31, 1991.

M. R. Geasler
for MYRON D. JOHNSRUD
Administrator

4-2-91
Date

Patricia D Boyle
Director, Cooperative Extension Service
University of Wisconsin

4-12-91
Date

NO. 89-EXCA-2-0883

AMENDMENT NO. 3
TO
COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF WISCONSIN
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

In accordance with Section IV, C-1, it is mutually agreed to extend the provisions of the Cooperative Agreement for the period January 1, 1992 through June 30, 1992.

Richard R. Rankin

RICHARD R. RANKIN
Deputy Administrator, Management

10/30/91
Date

Patrick D Boyle

Director, Cooperative Extension Service
University of Wisconsin

11/5/91
Date

No. 89-EXCA-2-0883

AMENDMENT NO. 4
to the
COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY of WISCONSIN
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Section IV, B-1 is amended as follows:

To provide additional funds in the amount of $10,000 in the next funding authorization under the Payment Management System. Including the $240,000 previously authorized, the total cost to ES-USDA under this Agreement will not exceed $250,000.

Section IV, C is amended as follows:

1. It is mutually agreed to extend the provisions of the Agreement for the period July 1, 1992, through September 30, 1992.

15. Section 638 of the fiscal year 1992 Agriculture Appropriation Act (Public Law 102-142) imposes the following requirement:

> "When issuing statements, press releases, requests for proposals, bid solicitations, and other documents describing projects or programs funded in whole or in part with Federal money, all grantees receiving Federal funds, including but not limited to State and local governments, shall clearly state (1) the percentage of the total cost of program or project which will be financed with Federal money, and (2) the dollar amount of Federal funds for the project or program."

MYRON D. JOHNSRUD
Administrator

8-5-92
Date

Director, Cooperative Extension Service
University of Wisconsin

8-13-92
Date